

GEORGIA INSTITUTE OF TECHNOLOGY  
OFFICE OF CONTRACT ADMINISTRATION  
SPONSORED PROJECT INITIATION

no action  
add  
CHL

Date: 12/8/76

Project Title: Conduct a Short Term Preliminary Study of Future Communication Needs of the Georgia Electric Membership Corporation.

Project No: A-1928

Project Director: Mr. R. W. Wallace

Sponsor: Georgia Rural Electric Service Corporation, Reynolds, Ga. 31076

Agreement Period: From December 1, 1976 Until March 1, 1977

Type Agreement: Standard Industrial Research Agreement

Amount: \$4,450

Reports Required: Final Report

Sponsor Contact Person (s):

Technical Matters

Contractual Matters  
(thru OCA)

Mr. Richard Parks  
Executive Vice President  
Georgia Rural Electric Service Corporation  
P. O. Box 398  
Reynolds, Ga. 31076

Defense Priority Rating:

Assigned to: \_\_\_\_\_ (School/Laboratory)

COPIES TO:

Project Director  
Division Chief (EES)  
School/Laboratory Director  
Dean/Director-EES  
Accounting Office  
Procurement Office  
Security Coordinator (OCA)  
Reports Coordinator (OCA)

Library, Technical Reports Section  
Office of Computing Services  
Director, Physical Plant  
EES Information Office  
Project File (OCA)  
Project Code (GTRI)  
Other \_\_\_\_\_

GEORGIA INSTITUTE OF TECHNOLOGY  
OFFICE OF CONTRACT ADMINISTRATION

SPONSORED PROJECT TERMINATION

Date: 3/25/77

Project Title: "Telecommunications Requirements Study for the Electric Membership Corporations of Georgia."

Project No: A-1928

Project Director: Mr. R. W. Wallace

Sponsor: Georgia Rural Electric Service Corporation, Reynolds, Georgia 31076

Effective Termination Date: 3/1/77

Clearance of Accounting Charges: 3/31/77

Grant/Contract Closeout Actions Remaining:

- ☒ Final Invoice ~~XXXXXXXXXXXX~~
- ☐ Final Fiscal Report
- ☐ Final Report of Inventions
- ☐ Govt. Property Inventory & Related Certificate
- ☐ Classified Material Certificate
- ☐ Other \_\_\_\_\_

Assigned to: Electronics Technology (School/Laboratory)

COPIES TO:

Project Director  
Division Chief (EES)  
School/Laboratory Director  
Dean/Director-EES  
Accounting Office  
Procurement Office  
Security Coordinator (OCA)  
Reports Coordinator (OCA)

Library, Technical Reports Section  
Office of Computing Services  
Director, Physical Plant  
EES Information Office  
Project File (OCA)  
Project Code (GTRI)  
Other \_\_\_\_\_



# ENGINEERING EXPERIMENT STATION

GEORGIA INSTITUTE OF TECHNOLOGY • ATLANTA, GEORGIA 30332

January 6, 1977

GRESO  
Box 398  
Reynolds, GA 31076

Attention: Mr. Richard Parks  
Executive Vice President

Subject: Monthly Letter Report No. 1  
Standard Industrial Agreement-dated 11/15/76

Gentlemen:

This project was initiated on December 1, 1976 and will be completed on March 1, 1977. The objective of the project is to conduct a short term preliminary study of future communications needs of the Electric Membership Corporations of Georgia.

The initial effort in the project has been dedicated to a survey of selected Electric Membership Corporations in the state. The survey is to include all Georgia based statewide EMC organizations and a sample of distribution EMCs representing a variety of terrain types, demographic regions, and size. A survey form, which is included as an attachment, was prepared to serve as a framework for discussions with the EMCs.

The following organizations were surveyed in December:

|             |            |
|-------------|------------|
| GEMC        | December 2 |
| SEDC        | December 3 |
| Cobb EMC    | December 6 |
| Carroll EMC | December 8 |
| OEMC        | December 9 |

In order to provide information from an EMC with more mountainous terrain, it was decided to survey Blue Ridge EMC instead of Hart EMC.

The remaining organizations are scheduled to be surveyed as follows:

|                |                  |
|----------------|------------------|
| Blue Ridge EMC | January 10       |
| GRESO          | January 11       |
| Flint EMC      | January 11       |
| Sumter EMC     | January 12       |
| Mitchell EMC   | January 12       |
| Washington EMC | To Be Determined |

The communications needs may be considered in two basic categories, voice and data. Voice communications includes both telephone and two-way radio systems. Data communications includes computer terminal, telex, and telemetric systems.

Some preliminary findings are listed below:

1. A capability for broadcast type information from some statewide agencies to all EMCs is required. Examples would be information on pending legislation affecting EMCs from GEMC and peak load data from OEMC.
2. Multichannel base and mobile radio systems are required that would allow mobile units from "foreign" EMCs to be efficiently integrated into local systems during emergency operations.
3. Independent limited range portable radio systems are needed for crew communications that don't require base monitoring.
4. Voice links independent of the dial telephone network are needed for statewide communications during emergencies.
5. Integration of EMC communications facilities with Georgia Power facilities should be considered. This would significantly reduce the cost of implementing a statewide EMC communications network.
6. Remote monitoring and control of substations should be considered.
7. Remote meter reading technology should be followed closely for future cost feasibility.
8. Printing of routine bills at SEDC should be considered. This would consolidate this activity at a location with a high speed line printer and decrease the traffic on the data lines.
9. The feasibility of installing an SEDC terminal at Oglethorpe should be determined. This would allow Oglethorpe to access the 20 EMCs on an individual or group basis for the dissemination of peak load information.



10. An integrated statewide voice and data communications plan should be developed which will allow distribution EMCs to purchase new equipment that would be consistent with the developing network.
11. A statewide communications coordinator should be named who would have the responsibility and the authority for implementing the statewide communications plan.

Respectfully submitted,

R.W. Wallace  
Project Director

RWW:mm  
Attachment

Approved: 

D.W. Robertson, Director  
Electronics Technology Laboratory

ATTACHMENT

COMMUNICATIONS SURVEY

- A. 1. What communications system is your organization currently using?  
For voice? For data? Radio Systems? Describe data systems.  
Describe other.
2. From your viewpoint, what is the greatest communications need?  
Administrative? Routine operational? Describe some of the problems.
3. Describe your current communication system in terms of wholly owned,  
common carrier, leased, or contract.
4. What innovations need to be accomplished, i.e., remote metering,  
load shaving, etc.?
5. Is point-to-point communications (across EMC lines and perhaps  
statewide) really needed? How often? District office to district  
office or truck to truck?
6. How large is your investment in communication services? Number of  
people directly involved in communication operations? Money?
7. List your priorities in communication needs?
- (a) Within your organization
  - (b) Your organization to others (who?)
  - (c) Statewide
  - (d) Office to office
  - (e) Truck to truck (between different organizations)
8. Have you recently studied your communication needs? What were the  
results? Any documentation or reports you could make available?

B. Voice

1. What links are required?
2. What are the reasons for the communications?
3. When will the communication be required?
4. What delay in establishing link can be tolerated?
5. How are the requirements being met by current communications systems?
6. What are the shortcomings of the current systems?
7. How will the requirements vary with operational and emergency conditions?
8. What are the reliability, maintenance, flexibility, and growth requirements?

C. Record

1. What links are required?
2. What are the reasons for the communications?
3. What amount of data must be transmitted in what amount of time?
4. When must data be moved?
5. What transmission delay can be tolerated?
6. How are the requirements being met by current systems?

7. What are the shortcomings of the current systems?
8. How will requirements vary with operational and emergency conditions?
9. What are the reliability, maintenance flexibility, and growth requirements?





# ENGINEERING EXPERIMENT STATION

GEORGIA INSTITUTE OF TECHNOLOGY • ATLANTA, GEORGIA 30332

4 February 1977

GRESO  
Box 398  
Reynolds, GA 31076

Attention: Mr. Richard Parks  
Executive Vice President

Subject: Monthly Letter Report No. 2  
Standard Industrial Agreement

Gentlemen:

This project was initiated on December 1, 1976, and will be completed on March 1, 1977. The objective of the project is to conduct a short term preliminary study of future communications needs of the Electric Membership Corporation of Georgia.

During the month of January the survey of organizations continued with the inclusion of the following organizations:

|              |            |
|--------------|------------|
| GRESO        | January 11 |
| Flint EMC    | January 11 |
| Sumter EMC   | January 12 |
| Mitchell EMC | January 12 |

Due to the adverse weather conditions, the visit to Blue Ridge EMC, scheduled on January 10, was postponed and is now scheduled for February 9, 1977.

In order to most effectively use the remaining time on the contract, it was decided to conduct the following interviews by telephone.

Washington EMC - Robert S. Moore  
Indiana, PA, Electric Power Corporation - Richard Orange  
Mississippi Electric Power Association - Hobson Waits

GRESO  
Page Two

An additional source of information on other states' communication systems, Mr. W.E. Adams (formerly of the Iowa EMC), has been suggested. If possible, he will also be interviewed by telephone.

Following these interviews the final report will be prepared and submitted by March 1, 1977. This report will contain a summary of our survey findings, a review of regulatory considerations, and recommendations for future systems development. A suggested outline of the final report is attached.

Georgia Tech will provide the required assistance in a presentation of the findings at the managers' meeting in March.

At the end of December the financial status of the contract was as follows:

|              |            |
|--------------|------------|
| Budget       | \$4,450.00 |
| Expended     | \$1,402.24 |
| Encumbered   | \$ 27.00   |
| Free Balance | \$3,020.76 |

Respectfully submitted,

Ronald W. Wallace  
Research Engineer

RWW:mm

Attachment

Approved: (

D.W. Robertson, Director  
Electronics Technology Laboratory

## OUTLINE

### Final Report

#### Executive Summary

1. Introduction
2. Survey Results
  - 2.1 Statewide Organizations
  - 2.2 Distribution EMCs
  - 2.3 Other State Systems
3. Communication Requirements
  - 3.1 Communications Center
  - 3.2 Voice
    - 3.2.1 Two way Radio
    - 3.2.2 Telephone
  - 3.3 Data
4. Regulatory Considerations
5. Recommendations
  - 5.1 Statewide Coordinated Radio Plan
  - 5.2 Statewide Data Communications Plan
  - 5.3 Further Study

#### Appendixes



## ENGINEERING EXPERIMENT STATION

GEORGIA INSTITUTE OF TECHNOLOGY • ATLANTA, GEORGIA 30332

14 March 1977

GRESKO  
Box 398  
Reynolds, GA 31076

Attention: Mr. Richard Parks  
Executive Vice President

Subject: Monthly Letter Report No. 3  
Standard Industrial Agreement

Gentlemen:

This project was initiated on December 1, 1976, and was completed on March 1, 1977. However, the account will remain open through the end of March to cover the expenses involved in printing the final report, preparing presentation materials, and attending the EMC managers meeting on March 21.

The survey effort continued in February with a visit to Blue Ridge EMC on February 9 to interview Mr. John Marlin, Manager. The manager of Washington EMC, Mr. Schley Moore, was interviewed by telephone on February 23. Information on the Pennsylvania REA radio system was obtained via telephone from Mr. Clair Limrick, Southwest Central Cooperative, on February 10; Mr. Luniger, Southwest Central Cooperative, on February 11; and Mr. Alec Porter, United Electric Corporation, on February 14. Numerous attempts were made to contact Mr. W. E. Adams of Iowa with no success. Discussions with Mr. Jim Heifner of GEMC revealed that the Mississippi statewide system consisted of base relays only and as such would not merit investigation at this time.

The final report was written and draft copies were presented to the Statewide Radio Communications Committee on March 3. Final corrections were incorporated into the report following this meeting.

Efforts remaining on the project are the preparation of vugraph material for the managers meeting on March 21 and Georgia Tech's participation in the meeting to present the results of the study.



GRESO  
14 March 1977  
Page Two


At the end of February the financial status of the contract was as follows:

|              |            |
|--------------|------------|
| Budget       | \$4,450.00 |
| Expended     | 4,346.52   |
| Encumbered   | 36.00      |
| Free Balance | 67.48      |

Respectfully submitted,

Ronald W. Wallace  
Project Director

RWW:gh

Approved: 

D. W. Robertson, Director  
Electronics Technology Laboratory

26.0.0  
11.1.13

A-1928

# TELECOMMUNICATIONS REQUIREMENTS STUDY FOR THE ELECTRIC MEMBERSHIP CORPORATIONS OF GEORGIA

By

R. W. Wallace, Project Director

R. W. Moss

R. W. Rice

Prepared for

GEORGIA RURAL ELECTRIC SERVICE  
CORPORATION  
REYNOLDS, GEORGIA

MARCH 1977

1977



COMMUNICATIONS TECHNOLOGY GROUP  
ELECTRONICS TECHNOLOGY LABORATORY  
GEORGIA INSTITUTE OF TECHNOLOGY  
ATLANTA, GEORGIA 30332

TELECOMMUNICATIONS REQUIREMENTS STUDY  
FOR THE ELECTRIC MEMBERSHIP CORPORATIONS OF GEORGIA

By

R. W. Wallace, Project Director  
R. W. Moss  
R. W. Rice

Prepared for

GEORGIA RURAL ELECTRIC SERVICE CORPORATION  
REYNOLDS, GEORGIA 31076

Georgia Tech Project A-1928  
March 1977

COMMUNICATIONS TECHNOLOGY GROUP  
ELECTRONICS TECHNOLOGY LAB  
GEORGIA INSTITUTE OF TECHNOLOGY  
ATLANTA, GEORGIA 30332



## FOREWORD

This report was prepared by the Communications Technology Group of the Electronics Technology Laboratory at the Georgia Institute of Technology under a standard industrial agreement with the Georgia Rural Electric Service Corporation. The work described was directed by Mr. R. W. Wallace under the general supervision of Mr. R. W. Moss, Head, Communications Technology Group.

The guidance and assistance of Mr. Richard Parks, Executive Vice President of GRESCO and Mr. Jim Heifner, Director of Safety and Education for GEMC are gratefully acknowledged. In the Electronics Technology Lab, the contributions of Ms. Merle Milloff, Ms. Gayle Hudson, and Mr. Larry Jackson are acknowledged.

## ABSTRACT

A survey and preliminary study of the telecommunications requirements of the Electric Membership Corporations of Georgia has been performed by Georgia Tech.

The results of a survey of all statewide EMC organizations, seven distribution EMCs, and out-of-state systems are reported. The communications requirements and alternatives for voice and data communications and the regulatory considerations are presented. Recommendations are presented for general telecommunications planning, a statewide coordinated radio plan, a statewide data communications plan, and areas for further study.

## TABLE OF CONTENTS

|  | <u>PAGE</u> |
|--|-------------|
| 1. INTRODUCTION . . . . .                                  | 1-1         |
| 2. SURVEY RESULTS . . . . .                                | 2-1         |
| 2.1 Statewide Organizations . . . . .                      | 2-1         |
| 2.1.1 Georgia Electric Membership Corporation. . . . .     | 2-2         |
| 2.1.2 Southeastern Data Cooperative. . . . .               | 2-3         |
| 2.1.3 Oglethorpe Electric Membership Corporations. . . . . | 2-6         |
| 2.1.4 Georgia Rural Electric Service Corporation . . . . . | 2-8         |
| 2.2 Distribution EMCs . . . . .                            | 2-9         |
| 2.2.1 Voice-Radio. . . . .                                 | 2-9         |
| 2.2.2 Voice-Telephone. . . . .                             | 2-16        |
| 2.2.3 Data Communications. . . . .                         | 2-17        |
| 2.3 Out of State Systems. . . . .                          | 2-19        |
| 3. COMMUNICATIONS REQUIREMENTS AND ALTERNATIVES . . . . .  | 3-1         |
| 3.1 Voice . . . . .  | 3-1         |
| 3.1.1 Present Capabilities . . . . .                       | 3-1         |
| 3.1.2 Requirements . . . . .                               | 3-3         |
| 3.1.3 Alternatives . . . . .                               | 3-3         |
| 3.2 Data . . . . .   | 3-4         |
| 3.2.1 Present Capabilities . . . . .                       | 3-4         |
| 3.2.2 Requirements . . . . .                               | 3-4         |
| 3.2.3 Alternatives . . . . .                               | 3-6         |
| 3.3 Other Requirements. . . . .                            | 3-7         |
| 3.3.1 Weather Information. . . . .                         | 3-7         |
| 4. REGULATORY CONSIDERATIONS. . . . .                      | 4-1         |
| 5. RECOMMENDATIONS. . . . .                                | 5-1         |
| 5.1 General Telecommunications Recommendations. . . . .    | 5-1         |
| 5.2 Statewide Coordinated Radio Plan. . . . .              | 5-3         |
| 5.3 Statewide Data Communications Plan. . . . .            | 5-4         |
| 5.4 Recommendations For Further Study . . . . .            | 5-4         |

TABLE OF CONTENTS (Continued)

|  | <u>PAGE</u> |
|--|-------------|
| APPENDIX A - Members of Statewide Radio Communications<br>Committee . . . . .                      | A-1         |
| APPENDIX B - Objectives for Communications Study Committee . . .                                   | B-1         |
| APPENDIX C - Communications Survey Questionnaire . . . . .   | C-1         |
| APPENDIX D - Operations Manual for Pennsylvania Statewide<br>Radio Communications System . . . . . | D-1         |
| APPENDIX E - Information on WATS . . . . .   | E-1         |
| APPENDIX F - Dimension PBX Features. . . . .   | F-1         |



## LIST OF FIGURES

### Chapter 2

|   | <u>PAGE</u> |
|---|-------------|
| 2-1 Data Communications Used by EMCs in Georgia . . . . .   | 2-5         |
| 2-2 Radio Frequency Bands Used by EMCs in Georgia . . . . . | 2-12        |
| 2-3 PREC Radio Configuration . . . . .                      | 2-20        |

### Chapter 3

|  |     |
|--|-----|
| 3-1 Illustration of Local EMC Voice Communications . . . . .   | 3-2 |
| 3-2 Southern Bell Radio-Telephone Coverage Areas . . . . .     | 3-5 |
| 3-3 Georgia Coverage by VHF Radio Weather Broadcasts . . . . . | 3-8 |

### Appendix D

|   |     |
|---|-----|
| 1 Control Station Components . . . . .  | D-3 |
| 2 Control Components . . . . .          | D-4 |
| 3 Typical Repeater System . . . . .     | D-5 |
| 4 Repeater Talk-Through Codes . . . . . | D-5 |

### Appendix E

|  |     |
|--|-----|
| E-1 In State WATS Costs for Georgia - 2/9/77 . . . . . | E-3 |
|--|-----|

## LIST OF TABLES

### Chapter 2

|   | <u>PAGE</u> |
|---|-------------|
| 2-1 Statewide Organization Interview Schedule . . . . . | 2-1         |
| 2-2 Distribution EMC Interview Schedule . . . . .       | 2-10        |
| 2-3 Summary of Surveyed EMC Characteristics . . . . .   | 2-11        |
| 2-4 AEPSC Microwave Channel Utilization . . . . .       | 2-21        |
| 2-5 Causes of Circuit Interruptions . . . . .           | 2-22        |

### Appendix D

|   |     |
|---|-----|
| 1 P.R.E.A. Repeater Talk-Through and Talk-Around Assignments. | D-6 |
| 2 P.R.E.A. Control Station Functions. . . . .                 | D-6 |

## 1. INTRODUCTION

This report presents the results of a preliminary study of the communications requirements of the Electric Membership Corporations of Georgia. The study extended over a period of three months from December, 1976, through February, 1977. During this period 11 Georgia EMC organizations were visited and 21 representatives of these organizations were interviewed. Information was obtained on three systems outside the state of Georgia. The information gathered has been summarized and assessed in the following pages.

The first part of the report presents the results of the survey of EMC personnel and is followed by a description of the communications requirements and alternatives as indicated by the survey. The next section presents a review of the regulatory considerations. The final section presents a set of recommendations based on the findings of the study.

Preliminary to the study, Georgia Tech obtained a copy of the list of objectives prepared by the statewide Radio Communications Committee. These objectives were valuable in establishing the parameters of the survey. The members of the statewide Radio Communications Committee are listed in Appendix A while the study objectives are included as Appendix B.

## 2. SURVEY RESULTS

A major effort during the project was to survey all of the statewide EMC organizations, a sample of the distribution EMCs, and selected systems in other states. The purpose of the interviews was to determine the communications needs of the EMCs, both on a statewide and local basis.

A questionnaire was developed which served as a basis for the interviews. The questionnaire was designed to cover general telecommunications requirements, voice requirements - both radio and telephone, and record or data requirements. A copy of the questionnaire is included as Appendix C. The results of the survey are summarized in the following paragraphs.

### 2.1 Statewide Organizations

The interview schedule for the statewide organizations is listed in Table 2-1.

TABLE 2-1

STATEWIDE ORGANIZATION INTERVIEW SCHEDULE

| <u>Organization</u>                           | <u>Persons Interviewed</u>  | <u>Date</u> |
|---|---|-------------|
| Georgia Electric<br>Membership Corporation    | Heywood C. Gay, Executive<br>Vice President   | December 2  |
| Georgia Rural Electric<br>Service Corporation | Richard Parks, Executive<br>Vice President  | January 11  |
| Oglethorpe Electric<br>Membership Corporation | Forrest F. Stacy, General<br>Manager<br>Charles R. Burgett, Director<br>of Operations | December 4  |
| Southeastern Data<br>Cooperative              | Jim Johnson, Senior Vice<br>President   | December 3  |

The interviews generally lasted from three to four hours each. The GEMC interview was conducted by Ronald W. Wallace and Dr. Robert W. Rice of Georgia Tech. The remaining interviews were conducted by Ron Wallace accompanied by Jim Heifner of GEMC.

The following paragraphs give the results of the interviews with the statewide organizations' executives. The paragraphs are organized in the chronological order of the interviews.

#### 2.1.1 Georgia Electric Membership Corporation

The Georgia Electric Membership Corporation (GEMC) is primarily an administrative organization with responsibilities in the areas of legislative affairs, public reactions, safety and education, and economic development. Also included in GEMC's responsibilities is the publication of Rural Georgia magazine.

The only communications systems currently used by GEMC are the telephone and the mail. There is frequently the requirement to communicate with all 42 EMCs on the same subject. This requires sending 42 letters or, if the need is urgent, making 42 telephone calls. During General Assembly sessions, this need may occur two or three times a week. At other times, GEMC may need to call all of the EMCs three or four times a month. GEMC currently has a single outgoing statewide coverage WATS telephone line. Usage of this line is consistently heavy.

One important communications requirement is the need for rapid communications during times of emergencies such as ice storms, hurricanes, or tornadoes. During these times GEMC serves as a coordinating agency, both among the distribution EMCs and between the EMCs and other statewide organizations. Rapid communications are required for dispatching additional trucks into the stricken area and resupplying expended material. GEMC feels that it would be useful to have a statewide emergency communications system, which would allow them to communicate directly or through a relay with every base station and vehicle in the state. Such a statewide emergency communications system could also be used to disseminate information during pending emergency situations, such as icing

conditions, and for normal administrative matters during non-emergency conditions. GEMC feels that the system should allow them to communicate with GRESCO, SEDC, and OEMC the same as with the distribution EMCs.

Automobile radio-telephones have been found useful by GEMC when the system is available, but problems have been encountered with limited statewide coverage.

#### 2.1.2 Southeastern Data Cooperative

The Southeastern Data Cooperative (SEDC) provides account data processing services for the local EMCs. Currently SEDC serves 19 of the 42 EMCs in the state of Georgia plus several accounts outside Georgia.

SEDC is the most recent addition to the statewide EMC organizations, having been formed from elements of National Data Corporation in 1976. SEDC currently uses a dual Burroughs 6700 processing system on a leased basis from NDC. This system provides real-time account processing service, account billing, and distribution system engineering data.

Both voice and data communications systems are used by SEDC. These systems are described in the following paragraphs.

#### VOICE

SEDC has no radio communications, using the telephone network for all voice telecommunications. Through NDC, WATS service is available on a shared cost arrangement covering both Georgia and the contiguous United States. This service currently costs SEDC about \$500 per month. SEDC's primary use of voice communications is to communicate with the distribution EMCs using the data system and with the telephone companies which provide the transmission facilities. The service is satisfactory, and no requirement for radio equipment is foreseen.

#### DATA

Data communications provide the basis for SEDC's operation and thus are essential. The coverage area of SEDC's data communications system is

shown in Figure 2-1. The EMCs indicated in white are the 19 co-ops that are served by SEDC in the state of Georgia.

All processing is performed on the NDC Burroughs Model 7600 in Atlanta. Computer input-output terminals throughout the state are connected to the computer by eight leased data circuits. In addition, the system has two data lines that go to locations outside the state. Each line to the system may have one or more terminals connected to it based on the amount of data each terminal must carry. The system is based on the requirement for a one second response for a 50 character (about 10 words) message.

The data lines are leased from AT&T for a total of \$6,000 to \$7,000 per month. These lines may be either 1200 Baud (1300 words per minute), 2400 Baud (2600 wpm), or 4800 Baud (5200 wpm) lines. From the long distance lines the local telephone company provides interconnection to a modem (data modulator/demodulator) at the terminal location. The modem is generally a Bell System 202T or 201C type. Bell modems are generally preferred by SEDC since telephone company employees are more familiar with them and will provide maintenance for them. Other data sets may complicate the telephone company interface.

The system uses two primary types of terminals - data terminals and keyboard/CRT displays (scopes). The data terminals are Burroughs Models TC3500 and TC3800. These terminals are the primary input and output devices for the customer accounts. They have dual printers - one for system messages and one for printing forms such as account statements. The CRT displays are primarily used for account inquiries and do not provide a hard copy output capability.

The system provides real time customer accounting information based on terminal inputs. Data are maintained as needed to bill customers, post cash payments, post meter readings, and produce accounting and engineering reports. The engineering data are accumulated as byproducts of the billing information in conjunction with distribution system information stored in the computer. For example, transformer and line loading may be calculated and displayed.

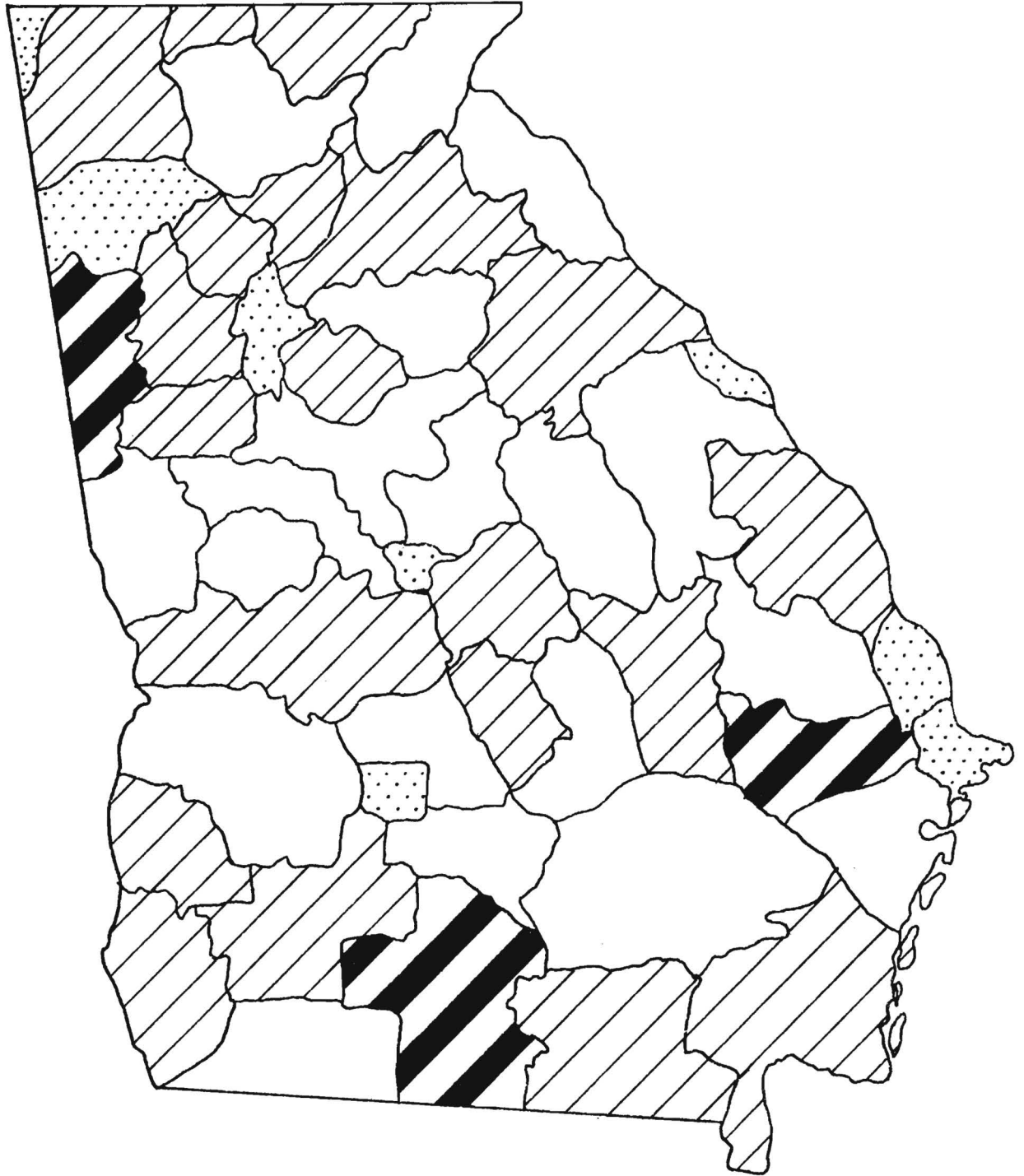


Figure 2-1. Data Communications Used by EMCs in Georgia.

Key: SEDG Network - White  
CCC Network - Black and White Stripes  
Other Systems - Diagonal Lines  
Not in EMC System - Dots



The system is basically a radial system with all communications connected between the computer and each terminal. Direct terminal to terminal communications are not provided. However, a feature is being implemented which allows terminal to terminal communications through the computer. This feature is currently projected to be available by March 6, 1977. The message capability will include both single terminal to single terminal and single terminal to multiple terminal communications yielding a broadcast capability. The computer system stores messages for any terminal that is off-line. When the terminal is turned on, all stored messages are transmitted to it.

The only problems noted by SEDC with the system are service interruptions in the data transmission circuits. These may be due to lines being down or to human error in operating the modem or switching equipment.

The cost of the service is dependent upon the tariffs for data lines. If these rates increase substantially, it will affect the cost of the service.

### 2.1.3 Oglethorpe EMC

Oglethorpe EMC was formed in August of 1974 to serve as a generation and transmission cooperative for the distribution EMCs. In this capacity OEMC acts as a wholesale purchaser of power primarily from the Georgia Power Company. OEMC also owns a portion of the statewide transmission network and co-owns generating facilities with Georgia Power and MEAG. Oglethorpe currently owns 17 percent of the statewide integrated transmission facility. Georgia Power is now contracted to operate and maintain OEMC's transmission facilities. OEMC serves 39 of the 42 EMCs in Georgia, the exceptions being Blue Ridge, North Georgia, and Tri-State EMCs.

Oglethorpe uses the telephone, mobile radio-telephone, and CB radio for voice communications and has a data line from Georgia Power for the indication of statewide power consumption and a dial up system for data transmission to a processor in St. Louis, MO.

## VOICE

Oglethorpe has recently installed a Dimension PBX system leased from Southern Bell. Information on this system is included in Appendix F. The main features of the system are listed below. This system is only available to telephone subscribers served by a central office with an Electronic Switching System.

- Call forwarding - allows user to transfer all incoming calls to another telephone in the local calling area.
- Three way calling - allows the addition of a third party to an established connection.
- Speed calling - allows the user to place calls to a list of eight or thirty frequently called numbers by dialing only one or two digits instead of seven to ten digits.
- Call waiting - notifies the user of a busy line of a call coming in. He may then place his current call on hold and connect to the new call.

OEMC is also tied into the Georgia Power telephone network. Essentially, Oglethorpe has the same access to the system as any Georgia Power office and may place toll free calls to all Georgia Power facilities on the network. Oglethorpe is only billed for the line between their office and Atlanta. The use of the system is included in OEMC's contract with Georgia Power. The system has been satisfactory to Oglethorpe with no observed overloaded condition on the lines.

The telephone system also includes two incoming and one outgoing statewide WATS lines with another outgoing line planned.

Oglethorpe has three mobile radio telephones which they have found very useful when in range of a base station since access to the statewide telephone system is provided. However, their range is limited, and lack of coverage often creates problems.

CB radios are often used by OEMC in communications with contract crews since all the crews seem to have them.

## DATA

Currently OEMC has a leased voice grade telephone line from Georgia Power in Atlanta which provides a real-time digital display of statewide power consumption. However, this information may not be of very high quality since some input data could be incorrect. Some inputs are not automatic but are manually set and may be erroneous at times. Also the reading is a gross reading which includes losses and station use, while a net reading is really needed.

System engineering and management processing are performed on a computer system owned by McDonnell-Douglas Automation Company in St. Louis, MO. The system uses a normal dial telephone line to connect a card input terminal in OEMC's office to the computer.

Oglethorpe's charges for power received from Georgia Power are derived from magnetic tape recordings of the readings at the system metering points throughout the state. These tapes are sent through the mail to a computer center where they are processed and the account data are produced. OEMC feels that this system has operated satisfactorily.

### 2.1.4 Georgia Rural Electric Service Corporations

The Georgia Rural Electric Service Corporation (GRESKO) is a cooperative-owned service organization serving the material and service requirements of the EMCs in Georgia. GRESKO serves as a distributor of the major supplies needed for the power distribution system, providing centralized supply of items ranging from line regulators to splicing sleeves. GRESKO also offers services including testing of booms and buckets and locating underground faults.

GRESKO's voice communications are served by the telephone. No data communications are currently required.

## VOICE

In addition to the normal business telephone service, GRESKO is having an incoming WATS line installed. Currently GRESKO has no radio

communications with their trucks. GRESKO expressed the need for the capability to communicate with their trucks throughout the state. Currently if a truck is returning from North Georgia and a pick-up requirement develops in Middle Georgia, there is no way to dispatch the truck while it is enroute.

During emergencies, GRESKO needs to be able to communicate rapidly with statewide coordinating agencies and the affected EMCs.

## 2.2 Distribution EMCs

A selected sample of seven distribution EMCs were surveyed during the study as indicated in Table 2-2. The EMCs were chosen as representatives of the state EMCs ranging in size from 7,000 to 30,000 members, representing locations from mountains to plains, representing population densities from urban to rural, including low band VHF, high band VHF, and UHF radio systems, and other variations as indicated in Table 2-3.

The survey results will be given as a summary of information from all the systems interviewed in order to indicate a consensus of communications requirements of the distribution EMCs.

The results are organized into voice-radio, voice-telephone, and data communications.

### 2.2.1 Voice-Radio

All of the systems surveyed used two-way mobile radio extensively in their operations. This form of communications is now considered essential to an EMC's operation. Users of low band VHF, high band VHF, and UHF radio systems were included in the survey. All were basically satisfied with their current systems for local use, although most systems had some small areas within the system not covered by the radio. Figure 2-2 indicates the EMCs using low band VHF, high band VHF, and UHF in Georgia.

The only system using remote relay stations was Blue Ridge, the use here being mandated by the terrain. Three relay stations located on mountain peaks give almost 100 percent coverage of the service area. The system is based on two frequencies, with all users transmitting on the first frequency and receiving on the second. As configured, all com-

TABLE 2-2

## DISTRIBUTION EMC INTERVIEW SCHEDULE

| <u>Organization</u> | <u>Persons Interviewed</u>   | <u>Date</u> |
|---------------------|--|-------------|
| Blue Ridge EMC      | John D. Marlin, Manager  | February 9  |
| Carroll EMC         | James M. Hubbard, Manager<br>D.M. Hendrix, Manager of<br>Operations<br>Miss Willie Mae Anderson,<br>Manager Office Services                                  | December 8  |
| Cobb EMC            | Paul E. Weatherby, Manager<br>Wayne Barrett, Manager of<br>Engineering<br>Ed Allgood, Supervisor of<br>Apparatus<br>Neal Pittman, General Service<br>Foreman | December 6  |
| Flint EMC           | J.O. Mills, Manager<br>Bobby Trussell, Director of<br>Engineering Services<br>C.J. Smith, Engineer   | January 11  |
| Mitchell EMC        | Wilburn C. Turner, Office<br>Manager<br>Tommy Peel, Engineer   | January 12  |
| Sumter EMC          | Jerry L. Dover, Manager  | January 12  |
| Washington EMC      | Schley Moore, Manager  | February 23 |

TABLE 2-3  
SUMMARY OF SURVEYED EMC CHARACTERISTICS

| EMC        | Number of<br>Members | Radio Band | Number of<br>Bases | Number of<br>Mobiles | Repeater | Telephone<br>Features         | Data<br>Processing  |
|------------|----------------------|------------|--------------------|----------------------|----------|-------------------------------|---------------------|
| Blue Ridge | 8,949                | UHF        | 1                  | 24                   | 3        | 3 Companies<br>In Area        | Service<br>Contract |
| Carroll    | 17,237               | Low Band   | 2                  | 31                   | No       | Ans. Service<br>Southern Bell | CCC                 |
| Cobb       | 30,280               | Low Band   | 1                  | 62                   | No       | Southern Bell                 | In House<br>NCR     |
| Flint      | 29,221               | High Band  | 3                  | 30                   | No       | 8 Leased<br>Lines             | In House<br>NCR     |
| Mitchell   | 12,515               | Low Band   | 3                  | 21                   | No       | Phone Patch                   | In House<br>IBM     |
| Sumter     | 6,715                | High Band  | 1                  | 27                   | No       | 2 In, 2 Out<br>Georgia WATS   | SEDC                |
| Washington | 7,024                | High Band  | 1                  | 28                   | Base     | Purchased<br>System           | SEDC                |

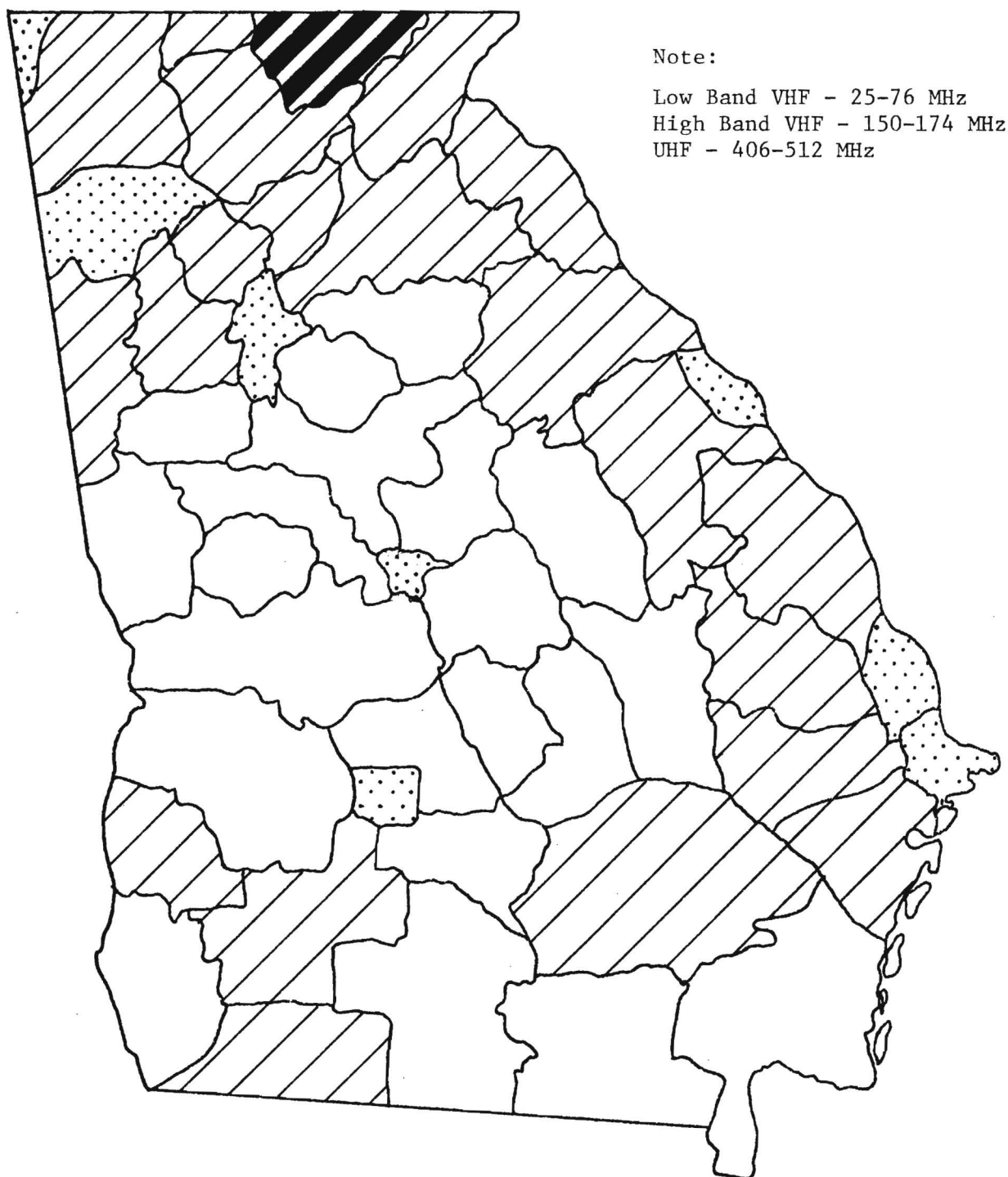


Figure 2-2. Radio Frequency Bands Used By EMCs in Georgia

Key: Low band VHF - diagonal lines  
High band VHF - white  
UHF - black and white stripes  
Not in EMC system - dots

munications must go through a relay station which receives on the first frequency and transmits on the second. Truck to truck communications are possible through the relay station. Blue Ridge is the only EMC using the UHF band in Georgia. Reliability of the system has been excellent; however, there has been occasional interference from a Georgia Power Company transmitter on the same frequency in Atlanta.

Washington EMC has a base relay system in the high band VHF range. The base station transmits on one frequency and receives on a second with all receptions from mobiles repeated. Direct mobile to mobile communications are possible through the base relay station.

The other EMCs had from one to three base stations operating independently. Operationally little interference has been noted, even though the base stations are on the same frequency. With more mobile units, this could become a problem. With 62 mobiles, Cobb's system is satisfactory but sometimes congested. During emergency situations the base stations are extremely busy with the situation described as "hectic."

Mobile-to-mobile communications are used throughout the systems surveyed. Often these communications are used during wire pulling or construction activities. Currently this does not interfere with base to mobile communications but could create delays in an expanding system. Some EMCs use walkie-talkies or CB radios for this type of communication and remain off the base-mobile network.

One system has experienced co-channel interference (another nearby EMC was assigned the same radio frequency) but eliminated the problem by installing a tone squelch system. This system blocks transmissions that don't have the proper tone included. (It may be called Channel Guard or Private Line by particular manufacturers.)

All EMCs surveyed indicated that there was a considerable problem in communicating with trucks from a foreign EMC which come into an area during emergency or disaster conditions. These trucks are normally on a different frequency and have no way of communicating with the base or mobiles of the home EMC. Normally the foreign trucks are assigned to a section of line for them to work on alone or a local truck is assigned to the for-



eign crew strictly for communications. Either way the system is dangerous, inefficient, or both. Various opinions were given on the concept of a communications system to alleviate this problem. Opinions ranged from the idea that these emergencies don't occur often enough to justify the cost of the system to the consideration that if the system saves just one life, it is justified. Most felt that such a system was needed, and if other than emergency use of the system could be designed into it, it could be justified.

One EMC, Carroll, has a plan to use a portable radio in a helicopter for an initial line patrol following the next disaster. It is estimated that this would decrease the restoration time by one day.

Another requirement that was frequently mentioned was the ability for people in the field to rapidly communicate with the Georgia Power Division Operator for transferring substation loads and performing switching operations. Information was obtained that Georgia Power is placing two-way radios in some substations which will enable direct communications with the Division Operator.

A need was indicated for the ability of EMCs to communicate with statewide organizations, particularly during emergency periods when telephone lines could be unusable. Further discussions revealed that the telephone network is rarely down completely during emergencies, but may be unusable due to overloaded circuits.

The desire to keep the radio system flexible in order to accommodate load management was expressed by several individuals. Cobb is currently using one of the high band VHF frequencies allocated for load control. This system uses a tone actuated control to turn off selected loads (such as air conditioners or hot water heaters) at houses equipped with the proper receiving equipment. Five thousand of these units were in operation in 1976, and their use has been instrumental in lowering Cobb's load during statewide peaks resulting in significant savings for Cobb's members.

Phone patches were used by several EMCs to connect their two way radios to the telephone system. The phone patches were used for connecting

mobile units to the Georgia Power D.O. and for after hours remote dispatching, for example. Experience with the phone patches has been described as excellent, good, and poor.

Interest in pagers for on call personnel after duty hours was expressed by several EMCs. This would allow these personnel to be relatively unhampered when on call. Carroll has used pagers for this purpose.

Some expressed an interest in regional after hours dispatch. It was felt that by pooling resources, the associated EMCs would have 24 hour coverage by a dispatcher which would eliminate the problems involved with members contacting recordings, answering services, or half-asleep on-call personnel. One concern expressed was the possibility of loss of EMC identity in a regional after hours dispatch.

Some EMCs expressed the desire to put two way radios in contractor vehicles while they were working on the system.

CB radio was mentioned by many as a possibility for members to communicate with the EMC during emergencies. As envisioned, the members would be informed via newsletter or with account flyers that the EMC would monitor a certain CB channel during emergencies for emergency information, such as lines down or power outages, only. Although interest was expressed in this concept, concern was indicated that the system could be abused by pranksters and nuisance calls. Blue Ridge has a CB base station installed for this purpose but has not had the need to use it at this time.

The importance of being aware of weather developments was emphasized by some EMCs. Some are in range of the VHF radio weather service and monitor it during developing conditions. However, these transmissions are available in only a limited part of the state. It was learned during the survey that the Georgia Power Company is installing a weather station at Pine Mountain, Georgia, which will include a weather RADAR set. Information from this system is not now available as it is understood that Georgia Power does not employ a meteorologist.

### 2.2.2 Voice-Telephone

All of the EMCs surveyed were satisfied with their telephone service. The only complaints noted were the difficulties sometimes encountered in establishing connections during emergency conditions and the problems associated with the fact that EMC boundaries often include several different telephone companies or areas.

It was noted that some EMCs may not be aware of how busy their incoming lines are. If the lines are often busy, it may be an indication that more lines are needed for satisfactory service. During major emergencies, the lines will become overloaded regardless of how well designed the system is for normal operations. During these overloaded conditions, it is often impossible to establish telephone communications between the EMC and statewide agencies or other EMCs in a reasonable amount of time. Some systems have alleviated this problem with the addition of an unpublished "hotline" number that is reserved for statewide use during emergency periods.

The problem with EMC boundary lines extending over more than one telephone system or billing area is that some member calls must be long distance toll calls. This problem has been met in several ways. Some systems accept collect calls for power outage reports. Others have installed leased lines into the various areas served giving all members a local telephone number to call. Some have installed Georgia WATS lines.

A number of systems used leased telephone lines to selected supervisors' homes in order to allow them to operate the base transmitter from their homes as a remote base operation. With this after hours dispatching may be accomplished without requiring the supervisor to leave his home.

A non-technical problem with the telephone system noted by some was the high cost of leased line service and the desirability of an economical alternative which would meet the communications requirements.

### 2.2.3 Data Communications

Data communications required by the EMCs may be placed in one of three categories--account data processing, administrative information, and system control processing. These three areas are discussed in the following paragraphs.

#### ACCOUNT DATA PROCESSING

All EMCs require account data processing of some type. Some EMCs have their processing done by a service organization operating in a batch mode, some use statewide real time processing services, and some have in-house batch or real time processing systems.

The first type requires no electronic data communications since the information is provided manually. The second type is most commonly used in the state and involves the services of an organization such as SEDC or CCC. In this system the EMC ties into a data communications network which ties many users to a large scale central processor. The third type system requires no data communications except that necessary to tie branch offices into the system.

The data communications circuits are the responsibility of the providers of the data processing system. Data grade circuits are leased from the associated telephone companies. The circuits are leased based on a line load analysis to provide a predetermined grade of service. Within the SEDC system, the grade of service is based on a one second response for a 50 character message. Apparently these objectives are being met and the users are satisfied with the system.

#### ADMINISTRATIVE INFORMATION

Administrative information includes both the normal textual information required in administering an EMC and the information required for effective load management.

Virtually all of the textual information transmission requirements are met by use of the postal service. The exceptions occur when items are hand carried to their destination. Although satisfactory for routine business, this system is unsatisfactory when timely information must be conveyed. Currently there is a relatively limited amount of vital textual information

which must be transmitted rapidly. There was some doubt as to whether a facsimile or telex system could be justified based on current needs. It was noted that if the major engineering firms serving the EMCs were included, the system feasibility would increase substantially.

Load management, however, presents a quite different picture. Presently OEMC and Cobb have a digital readout of the statewide consumption of power through links with Georgia Power. Although the information presented by this display is often tainted by inaccuracies, its use has proven valuable. To be most useful, this information should be filtered through someone knowledgeable about the limitations and validity of the data at any given time.

Throughout the survey, the opinion was unanimous that information for load management would be vital in the near future, probably even in the summer of 1977. The feeling was that everyone should have access to load information that would allow their co-ops to limit rate increases while meeting the demands of their members.

#### SYSTEM CONTROL PROCESSING

The third area of data communications is for the monitoring and control of the power distribution system. These circuits are normally provided by voice or data grade telephone circuits depending upon the required data rate and error rate. This system generally is designed to provide monitoring and control of a power substation at a central location. The following items may be included in a typical system.

- Operate disconnects
- Open and close circuit breakers
- Open and close non-reclosing switches
- Open and close ground relay switches
- Lower phase regulator voltage
- Return phase regulator voltage to automatic control
- Monitor current and voltage of feeders
- Monitor switch position and regulator settings

Although a number of EMCs anticipate a future requirement for remote system control, the only system known to be in the installation phase in

Georgia is at Cobb EMC. The Cobb system will provide all of the above listed functions, except for operating disconnects and monitoring switch positions and regular settings. These functions are planned to be added at a later date.

### 2.3 Out of State Systems

During the course of the study, information was obtained on three other state or regional systems - Pennsylvania REA, Mississippi Electric Power Association, and the American Electric Power Service Corporation.

The Pennsylvania system is a statewide system using six frequencies in the low band VHF region and eight tones. The fourteen state Rural Electric Cooperatives are divided into three groups with inter-REC communications normally only possible for RECs in the same group. For an added cost, radios may be equipped for full coverage.

Each REC is assigned a unique frequency/squelch tone combination. Although several RECs have identical frequency assignments, the tone assignments eliminate interference. The repeater configuration for a given REC is indicated in Figure 2-3. As shown in the figure, the control station transmits on the frequency f1 to the relay station, which retransmits the signal on frequency f2 to be received by the mobile unit. In a like manner, the mobile unit transmits on frequency f1, which is relayed through the repeater to the control station on frequency f2. This is the so-called talk through mode. In addition, the control station and all mobiles have a transmitter on frequency f2, allowing them to communicate directly without use of the repeater. This is termed the talk around mode.

The system has been successfully implemented with no significant interference problems, although users of the same frequency are in very close proximity.

For licensing purposes, Pennsylvania's REA established a statewide dummy organization called Voam, (from the contraction of Volt Amp) which is a joint licensee with each of the RECs. In this manner the frequencies are available for statewide use.

Appendix D includes the operating instructions for the PREA system.

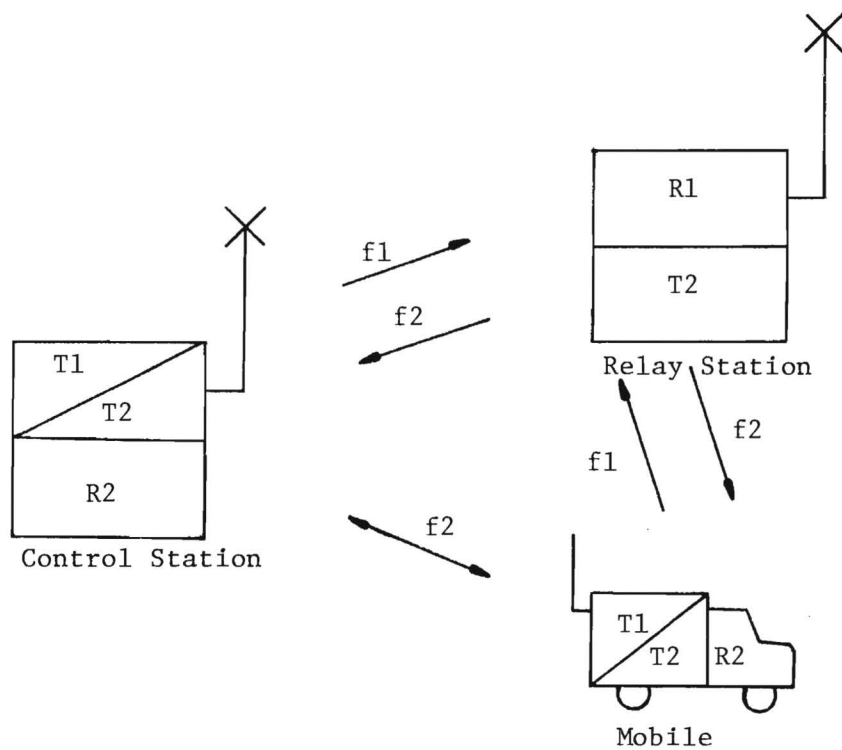


Figure 2-3. PREC Radio Configuration.

The Mississippi system consists of a simple base station repeater system which was not deemed to be worth pursuing within the limited time available.

The American Electric Power Service Corporation is a microwave system serving Indiana, Ohio, and parts of West Virginia and Virginia. The system is of interest here due to the data gathered on its channel utilization and interruption statistics. The system operates primarily at 6 GHz and includes over 1200 link miles, 18 terminal stations, 21 drop-channel repeaters, 22 through repeaters, and 5 billboard repeaters as reported in 1963.\* The system uses single sideband frequency division multiplexing for voice and frequency shift keying for telemetry data. Channel utilization is indicated in Table 2-4.

TABLE 2-4  
AEPSC MICROWAVE CHANNEL UTILIZATION

| Service              | Channel Miles | Percent of Total |
|----------------------|---------------|------------------|
| Voice dispatch       | 7290          | 43.5             |
| Voice administrative | 6170          | 36.8             |
| Telemetry            | 2805          | 16.7             |
| Radio Control        | 290           | 1.7              |
| Supervisory          | 205           | 1.2              |

The average per hop reliability for the system was generally in excess of 99.9 percent. The causes of circuit interruptions are listed in Table 2-5. With the advances in solid state equipment, it is projected that equipment failures would be a much smaller percentage for present systems.

\* Nelson, T. R., "Expansion of Microwave Facilities to Meet Increased Power System Needs," presented at the Northeastern District Meeting of IEEE, Portsmouth, NH, May 20-22, 1963.



TABLE 2-5  
CAUSES OF CIRCUIT INTERRUPTIONS

| Cause                            | Percent |
|----------------------------------|---------|
| Fading                           | 33      |
| Communications equipment failure | 45      |
| Power equipment failure          | 21      |
| Miscellaneous and unknown        | 1       |

### 3. COMMUNICATION REQUIREMENTS AND ALTERNATIVES

The preceding section has described the results of a survey of EMCs to define communication needs and requirements. The purpose of this section is to summarize these requirements and to set forth several alternative approaches to meeting the requirements. Since the scope of this short-term study was limited to a preliminary study, additional detailed study will be required to establish which alternatives are more cost-effective.

#### 3.1 Voice

##### 3.1.1 Present Capabilities

Presently most if not all of the EMCs achieve local voice communications by use of either two-way business radio or the commercial (Bell) telephone system. Telephone use is standard and includes local service, leased lines, WATS service, and long distance toll service.

The choice of toll, leased, or WATS service is dependent upon local requirements and operations. Each manager must perform a cost/benefit study in determining which service he should select. Appendix E contains some basic information on WATS charges. The graph in the appendix shows the tradeoff point between measured and full time intrastate WATS to be 40.4 hours. In other words, if more than 40.4 hours of WATS service per month are used, the full time WATS service is cheaper than measured service. For less than 40.4 hours, the timed WATS is more cost-effective.

Two-way radio is the primary method of communications to and from the EMC vehicular fleet. Typically, each EMC has one or more base units and a number of mobile units depending on the size of the vehicular fleet. The radio coverage area corresponds roughly to the EMC geographical boundaries, and two-way radio communications is generally possible throughout the EMC service area. In some EMCs, however, the radio coverage is less than adequate and some "gaps" in coverage exist.

Figure 3-1 illustrates these typical arrangements for local voice communications. Except for standard telephone service, local EMCs have no capability for state-wide voice communications.

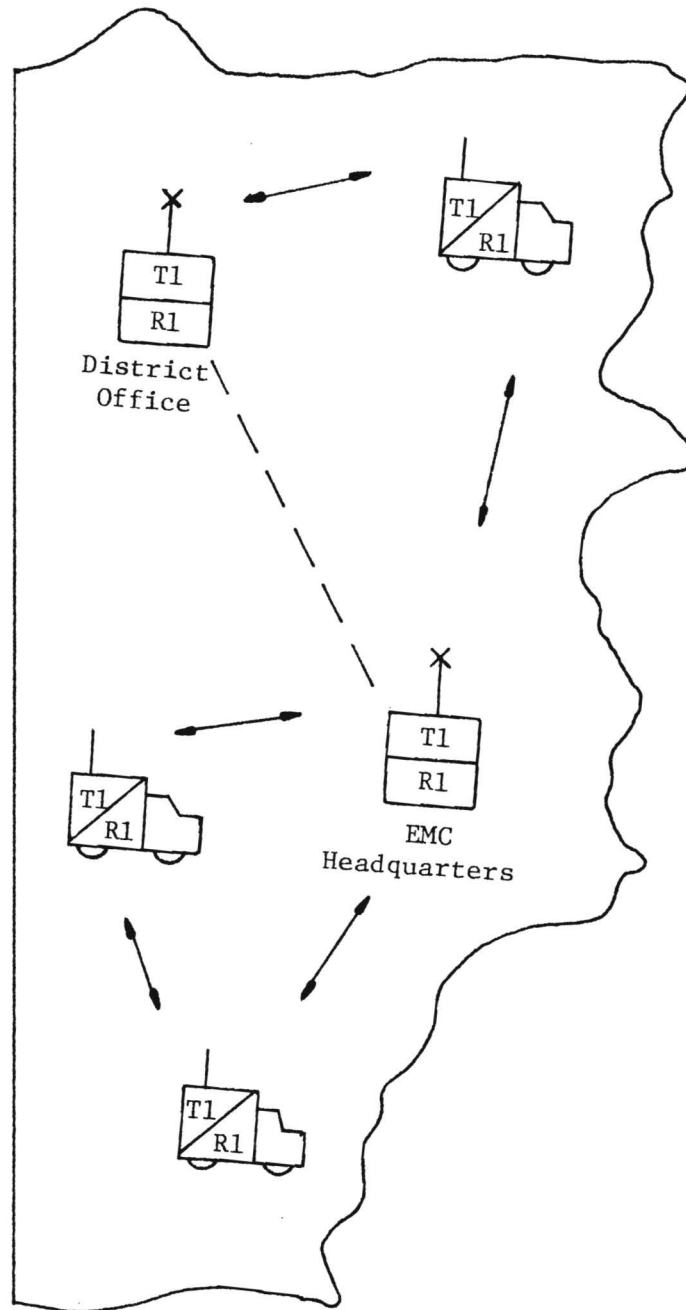


Figure 3-1. Illustration of Local EMC Voice Communications.

### 3.1.2 Requirements

Based on the survey results, the following voice communication requirements appear to be most important:

#### Local Voice

- Reliable full local radio coverage to entire EMC service area.
- Communications between local EMC and Georgia Power Division Operator.
- Inter-EMC radio communications under local emergency conditions.

#### Statewide Voice

- Dedicated capability for statewide voice, office-to-office, base-mobile, mobile-mobile.
- Capability to include local EMCs and statewide organizations such as GRESKO, OEMC, GEMC, and SEDC.
- Regional dispatch capability.

Contrasting current capabilities with these needs, the following conclusions are evident:

- The current local (intra-EMC) capabilities are reasonably adequate but are not well suited for future expansion into a statewide system.
- Inter-EMC radio communications under emergency conditions (different EMC vehicles in a common area) are not adequate.
- Except for conventional telephone, local EMCs cannot communicate with the Georgia Power Division Operator.
- No statewide dedicated voice communications is possible with the present system.

### 3.1.3 Alternatives

The present local voice capabilities are generally adequate for most EMCs, but a real and distinct need exists to expand the system for statewide voice capabilities. In addition, deficiencies are evident for emergency communications and for coordination with GEMC, GRESKO, OEMC, and Georgia Power.

Possible alternatives to overcome these deficiencies include:

- A statewide frequency allocation plan to include universal radio frequencies for inter-EMC and statewide organization communications.
- Use of the existing Georgia Power microwave system (via OEMC which is a participant) to accomplish wide area voice communications.
- Continued use of the Bell conventional telephone system but with greater reliance on dedicated or leased lines.

All of these alternatives appear viable initially, but further detailed study will be required to establish the most cost-effective approach.

One particular alternative which was considered briefly during this study was the use of the Bell Mobile telephone network. This network provides a mobile access capability to the telephone system. As shown in Figure 3-2, however, the current coverage of this system is not adequate for general purpose EMC needs. Only the larger Georgia cities are served, and the geographical coverage is rather limited.

## 3.2 Data

### 3.2.1 Present Capabilities

Business data communications is becoming a routine need for business practices, and the rural electric system of Georgia is no exception. Such activities as computerized billing, remote telemetry, and system management require local and long distance data communication capabilities.

Present inter-EMC data communication capabilities vary significantly with the size and location of each EMC. Capabilities range from non-existent to radio and wire-line telemetry.

Statewide and intra-EMC data communications is probably the greatest need. Present capabilities fall into two general capabilities: some EMCs have no statewide capability, and some EMCs use the services of SEDC to obtain a statewide capability. Even with the current SEDC system, however, the principal use is for billing.

### 3.2.2 Requirements

Based on the survey results, the following needs and requirements have been identified for data communications. (It should be noted that

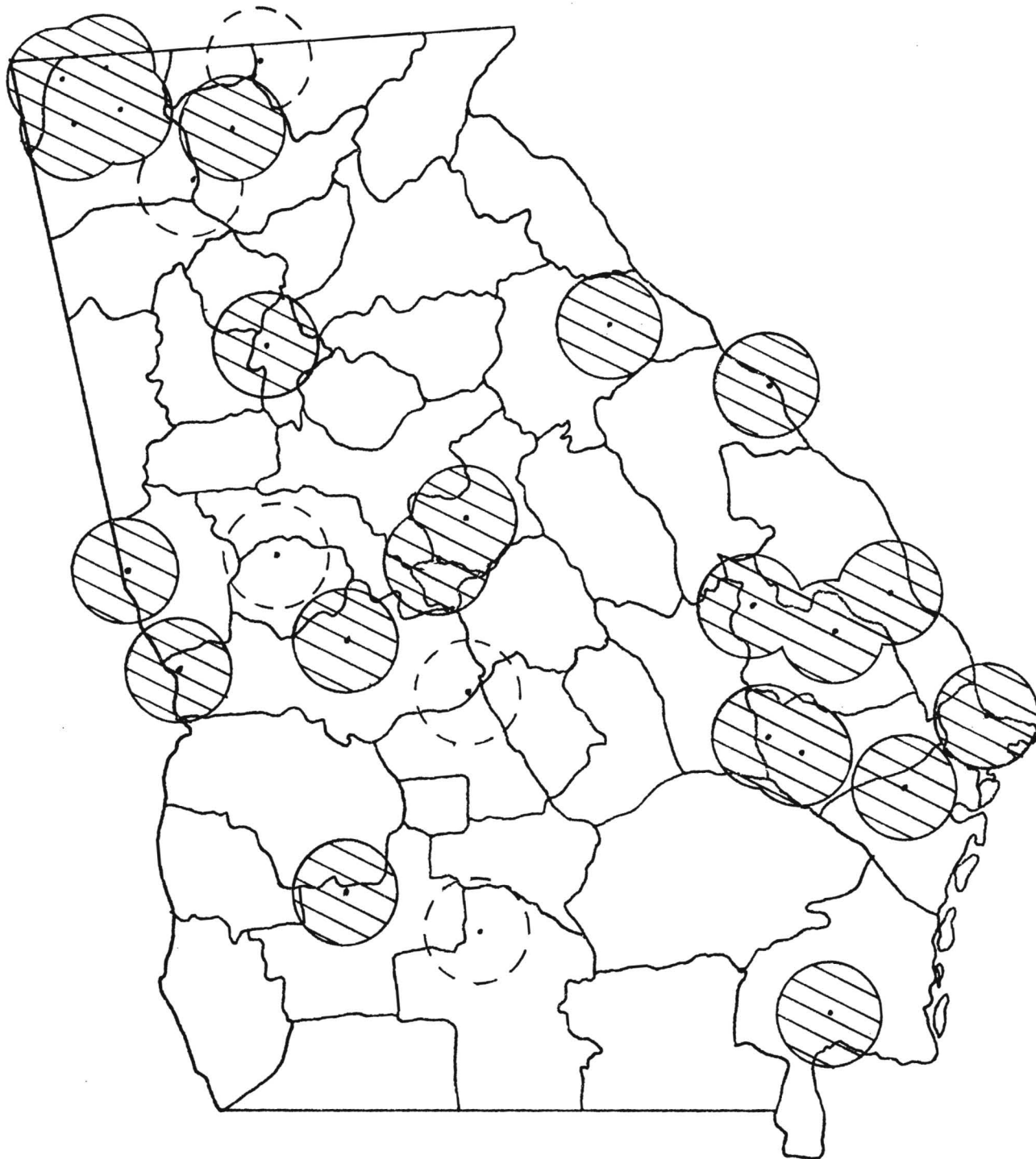


Figure 3-2. Southern Bell Radio-Telephone Coverage Areas.

data as used here refers to all digitized traffic, including Telex and Teletype type communications.):

- A distinct need exists to connect all Georgia EMCs into a statewide network. Future system management in such areas as load management, load shaving, equipment procurement, emergency conditions, etc. will require a statewide system.
- Those EMCs not participating in the SEDC or equivalent system will likely require a statewide tie-in in the future.
- All local EMCs need a capability to exchange Telex-type traffic on a routine basis.
- A statewide dispatch capability via voice or data would be useful to decrease local response time to routine or emergency outages.
- System monitoring requirements on a statewide basis will increase for activities such as remote telemetry, remote control, and power system status.

### 3.2.3 Alternatives

A variety of alternatives may be defined to satisfy future data communication needs:

- Expansion and use of the SEDC network to provide a statewide data communications capability between all EMCs and statewide organizations such as GRESCO, GEMC, and OEMC. This network should provide both a "multiple address" and a switched point-to-point capability.
- Use of the Georgia Power microwave system (via OEMC) to provide statewide needs.
- Use of radio telemetry or dedicated telephone line systems to satisfy local data requirements.
- Development of a statewide microwave system dedicated to rural electronic needs.
- Continued use of the Bell System but expansion to meet future statewide requirements.

### 3.3 Other Requirements

#### 3.3.1 Weather Information

During the course of this study, it was noted that weather information available from the National Weather Service (NWS) would be useful to EMCs. Such information is available from NWS at key forecast offices, such as Atlanta and Savannah, but the information is not readily available to remote EMCs. NWS weather information is disseminated via wire service and localized VHF radio. Figure 3-3 shows the estimated coverage area for the present VHF weather transmitters in Atlanta and Savannah. This coverage could be improved by use of highly elevated receiving antennas at EMC office locations, but not all EMCs could be served. One possibility to overcome this deficiency would be to re-transmit the weather information over a statewide voice system or to synopsise the information via a data channel.



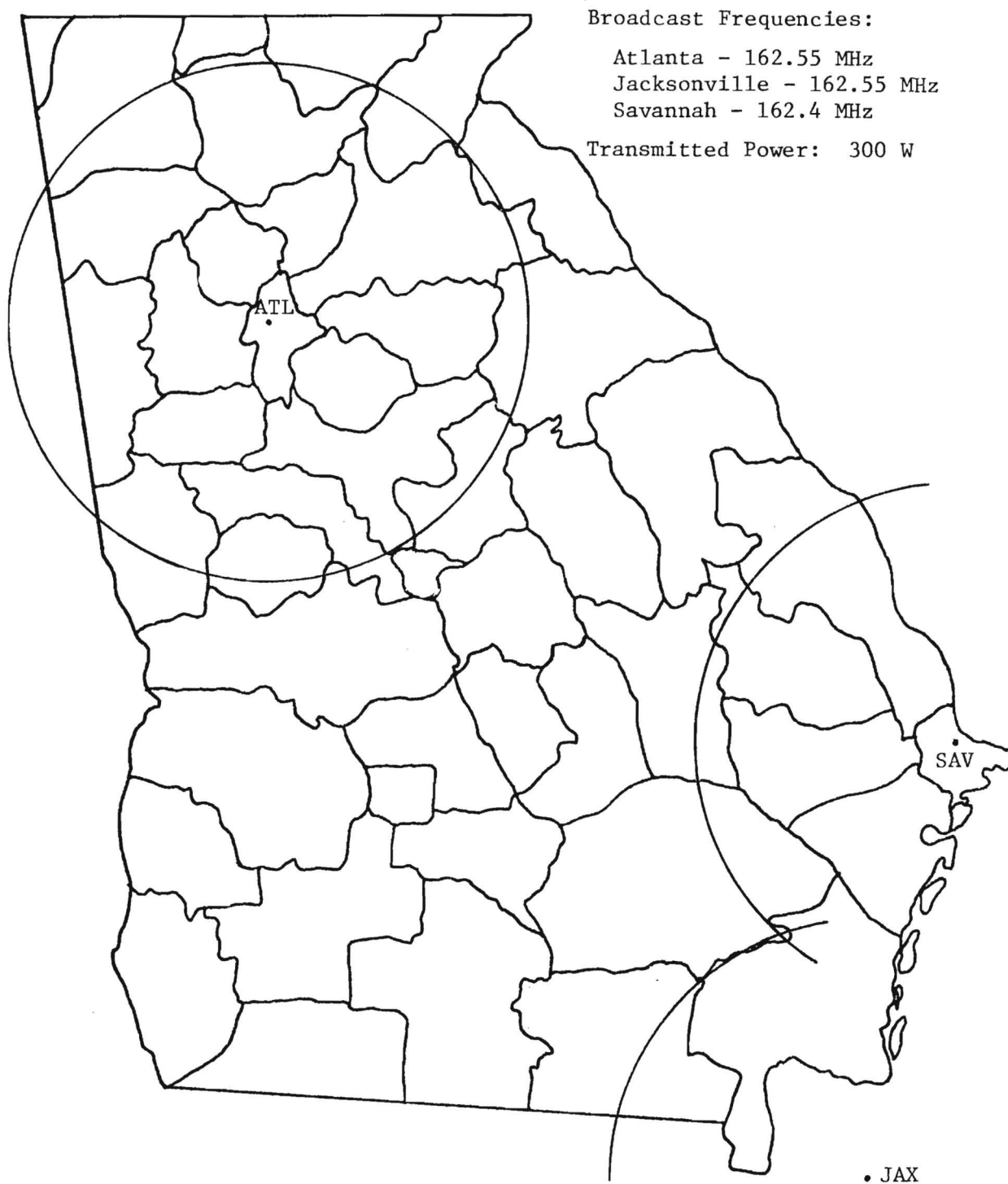


Figure 3-3. Georgia Coverage by VHF  
Radio Weather Broadcasts.

#### 4. REGULATORY CONSIDERATIONS

A variety of useful communications forms has been identified and discussed in the preceding material, and each operational form is surrounded by a body of rules, regulations, and laws which dictate the permissible modes of operation. The most significant body of literature on this topic is the Federal Communications Commission's Rules and Regulations. The use of two-way radio for communications by organizations which are a part of the power industry is allowed under Part 91 of the Commission's rules, and it is that section which must be consulted when considering new or different communication forms for the power industry.

The present form of radio communication for most of the EMCs involves a base station and its associated mobile units. The regulatory basis for this mode of operation is Part 91, Subpart D, paragraph 91.151 which defines the conditions under which this type of operation may occur. In general, mobile-to-mobile and mobile-to-base communication is permitted as long as all parties have the same license, communication is essential to the efficient conduct of business, and no effort is made to render a common carrier service. The latter point is identified in Part 91, Subpart A, paragraph 91.2.

A need has been expressed by the EMCs to acquire the ability to communicate with the mobile units of other EMCs by radio. The technical aspects of this have been discussed elsewhere in this report, and this section will identify when this may be done.

According to Part 91, Subpart D, paragraph 91.151, a station may communicate with any other station, without regard to type, service, or license, if the communication is directly related to safety of life or protection of property. This provides the means for station-to-station communication under emergency conditions, but this could not be used as the basis for routine station-to-station communications.

Provision has been made in the FCC's rules for routine communication through a single base station by mobile units of two or more licensees. This is the cooperative use described in Part 91, Subpart A, paragraph 91.6.

Under this arrangement, two or more licensees may use and/or operate a common base station. This would mean that a mobile unit from one EMC could communicate with the base station of another EMC if the appropriate arrangements have been made. It is worth noting, however, that mobile-to-mobile communication is not specifically addressed in the description of cooperative use; and, therefore, it is difficult to determine if it would be permitted under this arrangement.

There are several other important features of the cooperative use arrangement that should be pointed out:

- All participating parties must be eligible for a license in the same industrial radio service.
- A person who is to receive service from a base station licensed to a person other than himself may obtain a license for his own units, or
- A person who is to furnish a base station service to mobile radio units installed in vehicles owned and operated by persons other than himself may be the licensee of these mobile radio units.
- The cooperative use arrangement may be without a charge, or
- Contributions to capital and operating expenses may be accepted on a cost-sharing and non-profit basis, and the costs should be prorated on an equitable basis among all persons who are parties of the cooperative arrangement.

Additionally, there is the question of the frequency assignment for the various EMCs participating in a cooperative use arrangement. The usual cooperative use arrangement allows two or more users in the same geographical area to use a single channel. This arrangement is attractive if and only if the users do not object to delays caused by several users sharing a single base station. The EMCs, however, require the common channel operation on an infrequent basis, and would undoubtedly prefer a private channel of their own for their normal business. To accommodate both forms of operation, each EMC would have to be licensed to operate on

at least two frequencies: a common channel used between EMCs, and a private channel used within a given EMC. No mention of this form of operation has been found in the FCC's rules on industrial radio.

One possible means around the frequency assignment problem is the approach taken by the EMCs in Pennsylvania. There a statewide organization has been formed, and the members of that organization are the local EMCs. The statewide organization is eligible for and received a frequency assignment in the Industrial Radio Service. This assignment is used for the statewide communications link. Additionally, each individual EMC is eligible for a license in the Industrial Radio Service, and through this avenue the local EMC receives a unique frequency assignment for its own local use. The result of this approach is that each EMC has legal access to both local and statewide channels.

Another area of concern with respect to regulations is the formation of a network for data transmission. As long as all lines and switching are provided by existing common carriers, there is no regulatory difficulty. If, however, a data network is implemented which uses common carrier lines but has the message switching done by a computer or other device which is not owned by the common carrier, then it is possible that the common carrier will contend that the data network represents a competitive system which would not be legally allowed.

It is anticipated that the common carriers would object even more vigorously if the EMCs attempted to set up a microwave network to handle the transfer of data and voice signals. Their objection would most likely be that the network proposed by the EMCs is in direct competition with the common carrier service.

These comments on the restrictions on activities which might infringe upon existing common carrier service require consideration of the microwave link currently used by Georgia Power. In this case the link is owned and operated by Georgia Power. The networks discussed above would be used by multiple customers, and this is a basic part of the common carrier concept. If the EMCs were considered to be part of a single entity, this problem would not exist. If they are considered as autonomous units, then a legal ruling could be required.

On two other areas of concern, mobile to mobile operations in the power radio service are specifically allowed (FCC Rules and Regulations paragraph 91.151(1)) and contractors may apparently be included in the power radio network, so long as they are providing service to the system (FCC Rules and Regulations paragraph 91.154 (c)).

## 5. RECOMMENDATIONS

The recommendations based on the preceding study effort are organized into the following categories:

- General telecommunications recommendations
- Statewide coordinated radio plan
- Statewide data communications plan
- Recommendations for further study

Due to the limited scope of the study, these recommendations present an overview of the system requirements and do not attempt to intensively analyze any EMCs local needs.

### 5.1 General Telecommunications Recommendations

The current efforts of the Statewide Radio Communications Committee have been extremely valuable in providing the required leadership for the development of coordinated planning for communications. General recommendations and comments are listed below.

- A statewide communications coordinator should be named who would have the responsibility and the authority for implementing statewide telecommunications plans.
- To more accurately represent the scope of responsibilities, the name of the Radio Communications Committee should be changed to the EMC Telecommunications Committee.
- The committee should serve as a clearinghouse of telecommunications information for the statewide and distribution EMCs.
- A method for disseminating this information, such as in an employee newsletter, should be developed.
- Radio, telephone, and data subcommittees of the Telecommunications Committee should be formed in order to effectively monitor these specific areas.
- Operating objectives and standards should be developed for state and local systems.

- Cost-benefit analyses of statewide communications should be performed.
- Centralized purchase and maintenance of telecommunications equipment should be investigated.
- Telephone traffic analysis should be performed at all statewide organizations to insure proper WATS coverage.
- Distribution EMCs should analyze local requirements to insure proper application of WATS, leased line, and toll telephone services.
- All EMC organizations with two-way radios should have telephone patch capability.
- Establish CB radio emergency monitoring on a test basis.
- Establish facsimile capability at a few locations to determine cost effectiveness. (It would be useful to encourage engineering firms who do significant EMC contract work to lease compatible equipment.)
- Those EMCs within range should purchase VHF radio weather monitors.
- Keep abreast of remote meter reading developments to compare cost trends with manual meter reading cost trends.
- The possibility of connecting GEMC into OEMCs telephone system in order to gain access to Georgia Power's telephone system should be investigated.
- Where radio traffic is heavy, investigate use of limited range portable radio systems for work crews.
- Where radio traffic is heavy, consider splitting independent operations such as meter reading and service installation and disconnect into a separate radio channel from construction and line maintenance activities.

- Installation of at least an SEDC CRT keyboard terminal at OEMC should be considered immediately for dissemination of load management information.
- Consider printing of routine bills at SEDC on high speed line printer to reduce traffic on the data lines. Postage costs would be the same as local mailing; however, time for the mail to travel from Atlanta to local post office must be considered.
- A System Operation Center which is dedicated to the communications necessary to operate the distribution system should be established in each EMC. Ideally, it should be in an area isolated from background noise which would be adequate to serve all future radio dispatching requirements.

## 5.2 Statewide Coordinated Radio Plan

The two-way radio systems currently in use were established independently. A need for the future is to coordinate the system on a statewide basis. Currently the radio systems are spread throughout the VHF low and high band with one system using UHF equipment.

A plan should be developed that will ultimately place all EMCs in a limited frequency band. This would enable the implementation of multi-channel equipment that would include local and statewide frequencies.

The costs associated with a statewide independent microwave system should be investigated. The Georgia Power system has \$12 million invested at this time with a replacement cost in excess of \$20 million.

The relationship with Georgia Power should be reviewed regarding communications. Several options should be considered such as leasing channels on the Georgia Power system or using some of Georgia Power's physical facilities such as land, towers, and equipment shelters for an independent EMC microwave system. The possibility of establishing a statewide microwave system in conjunction with a common carrier organization should also be considered.



### 5.3 Statewide Data Communications Plan

In conjunction with a statewide radio plan, a statewide data communications plan should be established. The plan should include both account processing and message capability. The system could be built around the SEDC network or a new network could be organized on which SEDC would be a primary user. Alternatives for terminals should be investigated. Lease or purchase options need to be compared. A low cost terminal with limited capability for users who do not need full capability should be investigated.

Options on data transmission networks should be considered. Current and projected leased telephone line costs should be compared with independently owned options.

Statewide specifications for load management and monitoring and control of substations should be developed. As an integrated system, care must be taken that actions improving one EMC will not degrade the rest. The implementation of load management requires statewide coordination to be most effective for the entire system.

### 5.4 Recommendations for Further Study

To place statewide EMC communications on a firm foundation the following items are suggested for further study:

- Survey telecommunications facilities at all EMCs. (This should be in the form of a questionnaire rather than personal interviews.)
- Survey telecommunications requirements of all EMCs. (Again, a questionnaire rather than interview.)
- Establish proposed design for statewide radio plan.
- Establish proposed design for statewide data communications plan.

APPENDIX A

MEMBERS OF STATEWIDE RADIO COMMUNICATIONS COMMITTEE

STATEWIDE RADIO COMMUNICATIONS COMMITTEE

Charlie Burgett  
OEMC  
3951 Snapfinger Pkwy.  
Decatur, GA 30030

Jerry Dover  
Sumter EMC  
P.O. Box 1048  
Americus, GA 31709

Heywood Gay  
GEMC  
148 Cain Street - Suite 845  
Atlanta, GA 30303

Jim Heifner  
GEMC  
148 Cain Street - Suite 845  
Atlanta, GA 30303

Jim Hubbard  
Carroll EMC  
P.O. Box 629  
Carrollton, GA 30117

Jim Johnson  
SEDC  
P.O. Box 49592  
Atlanta, GA 30359

Bobby Moore  
Washington EMC  
P.O. Box 598  
Sandersville, GA 31082

Schley Moore  
SEDC  
P.O. Box 598  
Sandersville, GA 31082

Nash Murph  
Marshallville, GA 31057

Roy Palmer  
Mitchell EMC  
P.O. Box 409  
Camilla, GA 31730

Richard Parks  
GRESO  
Reynolds, GA 31076

Bud Stacy  
OEMC  
3951 Snapfinger Pkwy.  
Decatur, GA 30030

Ray Watson  
GEMC  
Star Route  
Dawsonville, GA 30534

APPENDIX B

OBJECTIVES FOR COMMUNICATIONS STUDY COMMITTEE

## OBJECTIVES FOR COMMUNICATIONS STUDY COMMITTEE

1. Any local distribution EMC to have adequate full local coverage plus be able to communicate with any other EMC vehicle in the state: i.e., mobile to mobile, base to base, base to mobile, mobile to base.
2. Statewide organizations, Georgia EMC, Oglethorpe EMC, GRESKO, SEDC, and CCC to be able to communicate with distribution EMC and all statewide organizations, bases, mobiles, statewide and local bases.
3. Each local EMC, mobile and/or base, to be able to communicate with the Georgia Power Company Division Dispatcher operator for its switching and service restoration.
4. To be able to dispatch local EMC vehicles from Regional after hours phone answering center for economy of operations.
5. EMC Consumers to be able to communicate not only by phone but by CB radio during major storm interruptions (ice, hurricane, etc.).
6. Microwave transmission of remote billing data processing vs. telephone lines.
7. For load shedding during peak periods and operation of peak shaving equipment and monitor transmission systems.
8. Supervises control systems of EMCs' systems, switching and capacitors, OCR's and other control.
9. Oglethorpe EMC to be able to transmit real time coincident peak data hourly during peak periods.
10. Integrated terminal at each co-op for communication system transmission (for example, Atlanta area URD digging).
11. Telex System for other co-op business. (Ordering material, sending P O's, etc.)
12. Remote reading of meters and other data.
13. Study 5, 10, 15 year needs of EMC's for related functions of communications by radio, microwave, telephone and other electronic methods.

14. Study radio maintenance methods (preventive and corrective).
15. Communications with contract crews (aircraft, etc.).

APPENDIX C

COMMUNICATIONS SURVEY QUESTIONNAIRE

## COMMUNICATIONS SURVEY

- A. 1. What communications system is your organization currently using?  
For voice? For data? Radio Systems? Describe data systems.  
Describe other.
2. From your viewpoint, what is the greatest communications need?  
Administrative? Routine operational? Describe some of the problems.
3. Describe your current communication system in terms of wholly owned,  
common carrier, leased, or contract.
4. What innovations need to be accomplished, i.e., remote metering,  
load shaving, etc.?
5. Is point-to-point communications (across EMC lines and perhaps  
statewide) really needed? How often? District office to district  
office or truck to truck?
6. How large is your investment in communication services? Number of  
people directly involved in communication operations? Money?
7. List your priorities in communication needs?
- (a) Within your organization
  - (b) Your organization to others (who?)
  - (c) Statewide
  - (d) Office to office
  - (e) Truck to truck (between different organizations)
8. Have you recently studied your communication needs? What were the  
results? Any documentation or reports you could make available?



B. Voice

1. What links are required?
2. What are the reasons for the communications?
3. When will the communication be required?
4. What delay in establishing link can be tolerated?
5. How are the requirements being met by current communications systems?
6. What are the shortcomings of the current systems?
7. How will the requirements vary with operational and emergency conditions?
8. What are the reliability, maintenance, flexibility, and growth requirements?

C. Record

1. What links are required?
2. What are the reasons for the communications?
3. What amount of data must be transmitted in what amount of time?
4. When must data be moved?
5. What transmission delay can be tolerated?
6. How are the requirements being met by current systems?

7. What are the shortcomings of the current systems?
8. How will requirements vary with operational and emergency conditions?
9. What are the reliability, maintenance, flexibility, and growth requirements?

APPENDIX D

OPERATIONS MANUAL FOR PENNSYLVANIA STATEWIDE  
RADIO COMMUNICATIONS SYSTEM



PENNSYLVANIA  
RURAL ELECTRIC  
ASSOCIATION

**Operating Instructions**  
**Control Stations**

**RCA**

IB-8028792

## INTRODUCTION

Your 2-Way Radio is part of a complex state-wide communications network that has been installed by the Pennsylvania Rural Electric Association. It is imperative that you thoroughly understand the operating features of your radio system - not only to achieve reliable communications for yourself, but to eliminate possible interference to other users of the network.

This operator's manual will help you become familiar with the location and use of the various components of your radio system. Read this manual carefully; it contains much information that will make using your radio easier.

## SYSTEM COMPONENTS

The major components of the control station radio system are shown in Figure 1.

**CONTROL STATION CABINET:** contains the radio transmitter and receiver. The cabinet

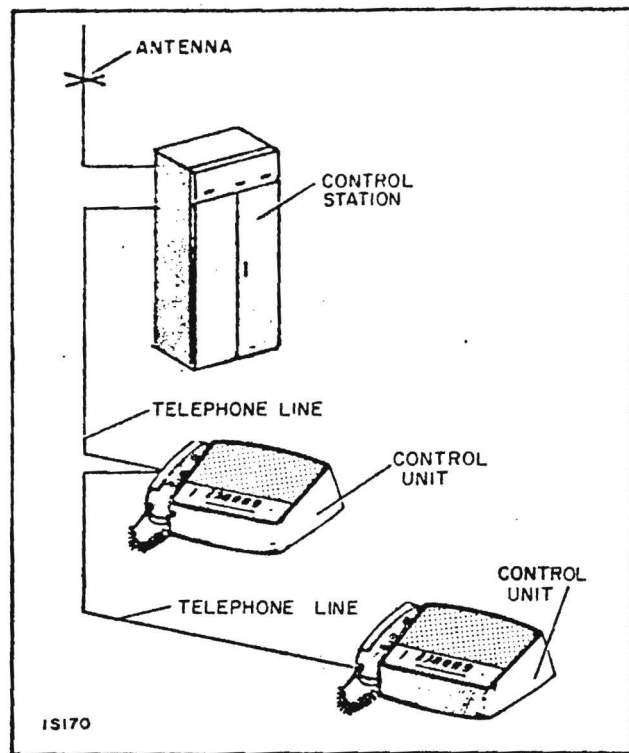


FIGURE 1. CONTROL STATION COMPONENTS

contains no operating controls, and is locked for your protection.

**NOTE:** The control station cabinet must not be opened by anyone other than qualified radio service personnel.

**CONTROL UNIT:** contains the operating controls for the station.

**SPEAKER:** operates when the handset is resting in the cradle. Loudness is adjusted by the VOLUME thumbwheel on the front panel.

**ON-OFF SWITCH:** turns the control unit on and off (does not switch power to the control station). Located at the rear of the control unit.

**VOLUME THUMBWHEEL:** adjusts the loudness of the sound coming from the speaker. Does not adjust loudness for handset earpiece.

**NOTE:** The volume adjustment does not affect the loudness of your signal to other stations.

**TRANSMIT LIGHT:** lights when the push-to-

talk button on the handset is pushed, indicating that the control station transmitter is "on the air".

**FUNCTION BUTTONS:** Select control station functions.

**ACCESS CODES:** select repeater talk-through or talk-around code. Pre-programmed for each control station (see Table 2).

**INTERCOM:** permits communications between all control units for a given control station without having signals "on the air".

**MONITOR:** disables the Quiet Channel feature of the station receiver. This allows you to hear all signals on your radio channel, regardless of the Quiet Channel code being used.

## THEORY OF OPERATION

Before using the radio, it is necessary to understand the principles under which it operates. Figure 3 shows a simplified diagram of a typical system.

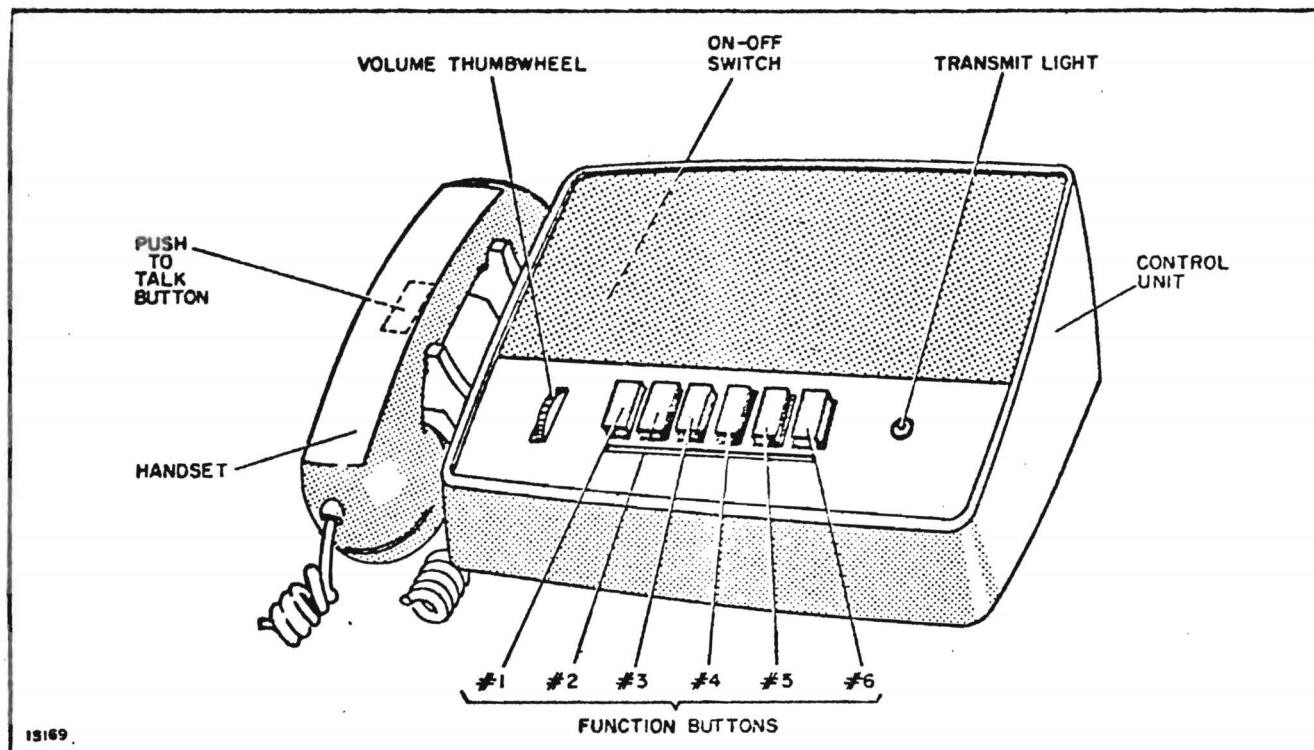


FIGURE 2. CONTROL COMPONENTS

**REPEATER:** A radio station that receives radio signals and automatically rebroadcasts them. Because the repeater has an advantageous location, it can greatly extend the operating range of the radio system.

**CONTROL STATION:** A fixed-location mobile radio station.

**TALK-THROUGH:** The process of having a radio signal rebroadcast by a repeater.

**TALK-AROUND:** The process of two radio stations communicating directly, without having their signals rebroadcast by a repeater.

The talk-around feature is used mainly as a back-up function. It can be used in case of a repeater failure, or in the event that a vehicle is outside the range of the repeater but within the range of the control station.

**RADIO CHANNEL:** The repeater stations of the member cooperatives of the Pennsylvania Rural Electric Association are grouped on one of three radio channels.

**QUIET CHANNEL CODE:** The receiver of any

station on a given radio channel will respond only to signals containing the proper Quiet Channel code. This includes all repeaters, control stations, vehicle systems, and portables.

**ACCESS CODES:** The combination of the radio channel and Quiet Channel code required to communicate with a specific station. Table 1 lists the repeater talk-through access codes and the talk-around codes used in the P.R.E.A. system.

Note that the talk-around feature can only be used between stations of the same talk-around group.

For example, a station from Group No. 1 cannot use the talk-around feature to communicate with stations from Group No. 2 or 3.

## OPERATING INSTRUCTIONS

Become familiar with the 10-Signals and the phonetic alphabet in the rear of this manual. They are helpful in providing clear, efficient communications.

(text continued on page 9)

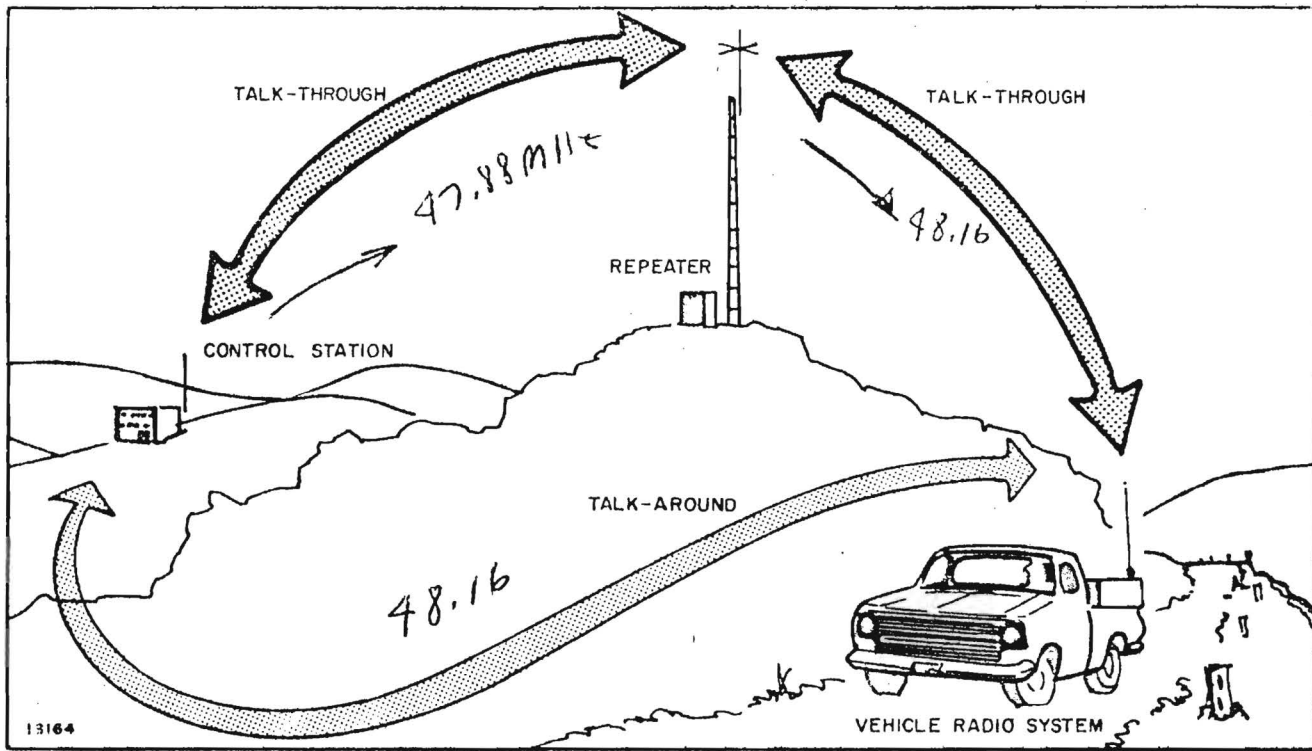


FIGURE 3. TYPICAL REPEATER SYSTEM

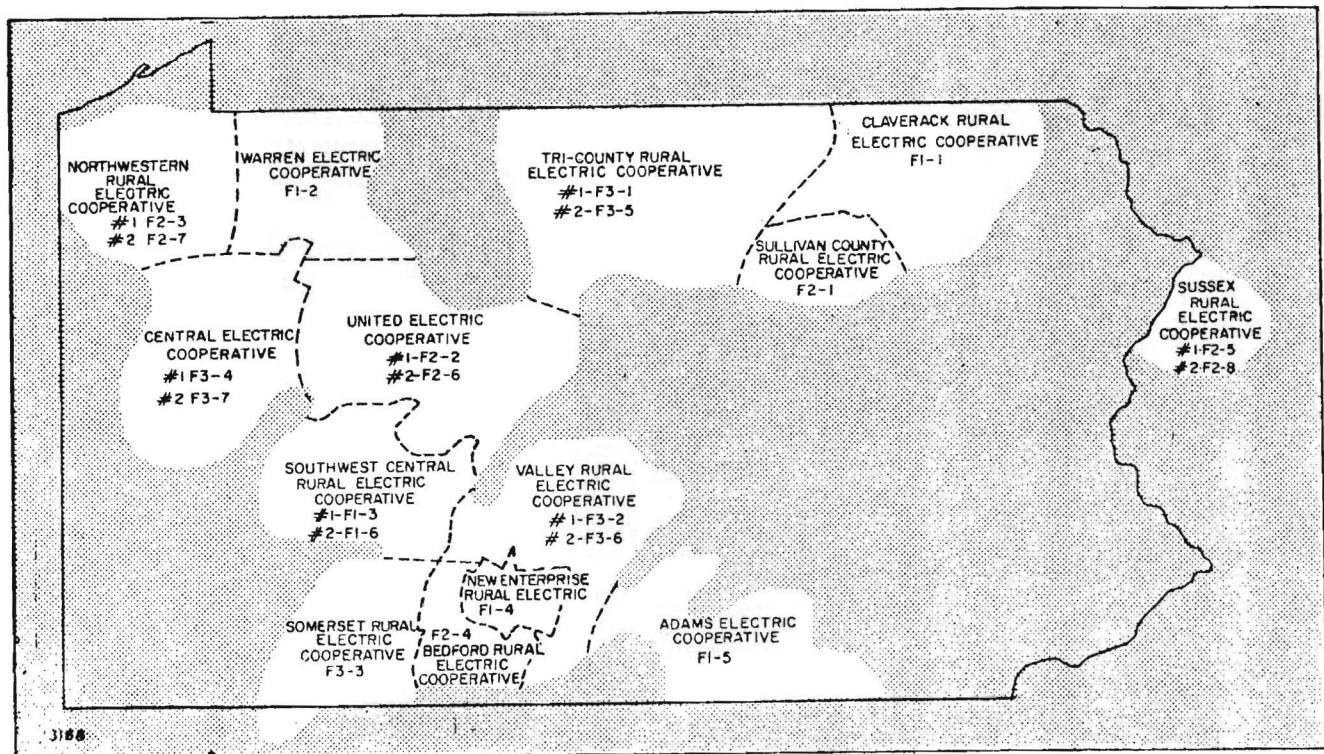


FIGURE 4. REPEATER TALK-THROUGH CODES

TABLE 1. P.R.E.A. REPEATER TALK-THROUGH AND TALK-AROUND ASSIGNMENTS

| COOPERATIVE          | TALK-THROUGH<br>ACCESS CODE |                          | TALK-AROUND ACCESS CODE |                          |       |
|----------------------|-----------------------------|--------------------------|-------------------------|--------------------------|-------|
|                      | RADIO<br>CHANNEL            | QUIET<br>CHANNEL<br>CODE | RADIO<br>CHANNEL        | QUIET<br>CHANNEL<br>CODE | GROUP |
| Claverack            | F1                          | 1                        | F4                      | 1                        | 1     |
| Warren               | F1                          | 2                        | F4                      | 2                        |       |
| Southwest Central #1 | F1                          | 3                        | F4                      | 3                        |       |
| Southwest Central #2 | F1                          | 6                        | F4                      | 3                        |       |
| New Enterprise       | F1                          | 4                        | F4                      | 4                        |       |
| Adams                | F1                          | 5                        | F4                      | 5                        |       |
| Sullivan             | F2                          | 1                        | F4                      | 1                        | 2     |
| United #1            | F2                          | 2                        | F4                      | 2                        |       |
| United #2            | F2                          | 6                        | F4                      | 2                        |       |
| Northwestern #1      | F2                          | 3                        | F4                      | 3                        |       |
| *Northwestern #2     | F2                          | 7                        | F4                      | 3                        |       |
| Bedford              | F2                          | 4                        | F4                      | 4                        |       |
| Sussex #1            | F2                          | 5                        | F4                      | 5                        |       |
| *Sussex #2           | F2                          | 5                        | F4                      | 5                        |       |
| Tri-County #1        | F3                          | 1                        | F4                      | 1                        | 3     |
| Tri-County #2        | F3                          | 5                        | F4                      | 2                        |       |
| Valley #1            | F3                          | 2                        | F4                      | 2                        |       |
| Valley #2            | F3                          | 6                        | F4                      | 2                        |       |
| Somerset             | F3                          | 3                        | F4                      | 3                        |       |
| Central #1           | F3                          | 4                        | F4                      | 4                        |       |
| *Central #2          | F3                          | 7                        | F4                      | 4                        |       |

\* Denotes repeaters used for Talk-Through to Harrisburg Emergency Control

TABLE 2. P.R.E.A. CONTROL STATION FUNCTIONS

| COOPERATIVE       | FUNCTION PUSHBUTTONS |              |              |              |              |              | TALK-<br>AROUND<br>GROUP |
|-------------------|----------------------|--------------|--------------|--------------|--------------|--------------|--------------------------|
|                   | BUTTON<br>#1         | BUTTON<br>#2 | BUTTON<br>#3 | BUTTON<br>#4 | BUTTON<br>#5 | BUTTON<br>#6 |                          |
| Claverack         | F1-1                 | F4-1         | INTERCOM     | MONITOR      | ----         | ----         | 1                        |
| Warren            | F1-2                 | F4-2         | INTERCOM     | MONITOR      | ----         | ----         |                          |
| Southwest Central | F1-3                 | F1-6         | F4-3         | (F4-6)       | INTERCOM     | MONITOR      |                          |
| New Enterprise    | F1-4                 | F4-4         | INTERCOM     | MONITOR      | ----         | ----         |                          |
| Adams             | F1-5                 | F4-5         | INTERCOM     | MONITOR      | ----         | ----         |                          |
| Sullivan          | F2-1                 | F4-1         | INTERCOM     | MONITOR      | ----         | ----         |                          |
| United            | F2-2                 | F2-6         | F4-2         | (F4-6)       | INTERCOM     | MONITOR      | 2                        |
| Northwestern      | F2-3                 | * F2-7       | F4-3         | (F4-7)       | INTERCOM     | MONITOR      |                          |
| Bedford           | F2-4                 | F4-4         | INTERCOM     | MONITOR      | ----         | ----         |                          |
| Sussex            | F2-5                 | (* F2-8)     | F4-5         | (F4-8)       | INTERCOM     | MONITOR      |                          |
| Tri-County        | F3-1                 | F3-5         | F4-1         | (F4-5)       | INTERCOM     | MONITOR      | 3                        |
| Valley            | F3-2                 | F3-6         | F4-2         | (F4-6)       | INTERCOM     | MONITOR      |                          |
| Somerset          | F3-3                 | F4-3         | INTERCOM     | MONITOR      | ----         | ----         |                          |
| Central           | F3-4                 | * F3-7       | F4-4         | (F4-7)       | INTERCOM     | MONITOR      |                          |

\* Denotes access codes for repeaters used for talk-through to Harrisburg Emergency Control.

(continued from page 5)

### PREPARING FOR OPERATION

Follow these steps to be sure that the control unit is ready for operation:

1. Turn power switch (rear of chassis) ON.
2. Adjust VOLUME thumbwheel for desired



listening level.

3. Be sure that the handset is placed in the cradle.

4. Push the desired Function Button (see Tables 1 and 2).

5. Remove the handset from the cradle and depress the push-to-talk button momentarily.

**NOTE:** The control station will only respond to a change in function after the push-to-talk button is depressed.

6. Release the push-to-talk button and replace the handset in the cradle.

## USING THE HANDSET

Use of the handset is similar to the use of a telephone handset, with the exception of the push-to-talk button. Keep the following hints in mind.

1. Always speak clearly, in a normal tone of voice. Shouting will not increase your range, and may actually hinder your communi-

cations, since it might make you harder to understand.

2. Depress the push-to-talk button and wait a few seconds before starting to talk. It takes a few seconds for the repeater to operate.

3. Always say "OVER" when you have finished talking, then release the push-to-talk button to listen.

4. Always replace the handset in the cradle when you have finished using the radio. Never leave it lying on the desk.

## CALLING ANOTHER STATION

Use the following procedure:

1. Push the desired access pushbutton (see Tables 1 and 2).

2. Depress the Monitor button for a few seconds to be sure that the radio channel is not in use.

3. Release the Monitor pushbutton, remove

11

the handset from the cradle, and place your call as follows:

- a. name of station being called
- b. name of your station
- c. the talk-through or talk-around access code being used
- d. "OVER"

### EXAMPLE:

"UNIT ONE-TWO-SEVEN, THIS IS BEDFORD CONTROL ON F - TWO - FOUR, OVER."

4. When the called station responds, you may then proceed with your message.

5. When you have completed your message, always say "CLEAR" and give your FCC call sign.

### EXAMPLE:

"BEDFORD CONTROL CLEAR, K \_ \_ \_ \_ \_."

6. Depress the access button used for normal operation. Depress the push-to-talk button

7. Release the push-to-talk button and replace the handset in the cradle.

## RESPONDING TO A CALL

When you are called by another station, the procedure is similar to the calling procedure:

1. Push the required access pushbutton (announced by the calling station).

2. Remove the handset from the cradle, and respond as follows:

- a. name of station calling you
- b. name your station
- c. the talk-through or talk-around access code being used
- d. "OVER"

### EXAMPLE:

"UNIT ONE-TWO-SEVEN, THIS BEDFORD CONTROL ON F- TWO - FOUR, GO AHEAD, OVER."

3. You may then proceed with your message.

4. When you have completed your message, always say "CLEAR" and give your FCC call sign.

#### EXAMPLE:

"BEDFORD CONTROL CLEAR, K \_ \_ \_ \_ \_."

5. Depress the access button used for normal operation. Depress the push-to-talk button momentarily.

6. Release the push-to-talk button and replace the handset in the cradle.

#### USING THE INTERCOM FEATURE

Depressing the Intercom button allows you to communicate with operators of other control units connected to your control station without going "on-the air". Use the following guidelines.

1. Depress the Intercom button.

2. Remove the handset from the cradle and proceed with your message.

3. When your messages are complete:

a. push the access button used for normal operation

b. depress the push-to-talk button momentarily

4. Release the push-to-talk button and replace the handset in the cradle.

#### SAMPLE TRANSMISSION

The following sample transmission is provided as a guide for proper operating practices:

BEDFORD CONTROL: "Unit one-nine, this is Bedford Control on F-two-four, OVER."

UNIT 19: "Bedford Control, this is unit one-nine on F-two-four, go ahead, OVER."

BEDFORD CONTROL: "Request 10-18. 10-91 at Jones Road and Route 30. OVER."

UNIT 19: "10-4 Bedford Control. Estimate 10-24 in fifteen minutes. OVER."

BEDFORD CONTROL: "10-4, Unit one-nine, Bedford Control CLEAR, K \_ \_ \_ \_ \_."

UNIT 19: "Unit one-nine CLEAR, K \_ \_ \_ \_ \_."

#### PHONETIC ALPHABET

|             |             |
|-------------|-------------|
| A - ADAM    | N - NORMA   |
| B - BOY     | O - OCEAN   |
| C - CHARLES | P - PAUL    |
| D - DAVID   | Q - QUEEN   |
| E - EDWARD  | R - ROBERT  |
| F - FRANK   | S - SAM     |
| G - GEORGE  | T - TOM     |
| H - HENRY   | U - UNION   |
| I - IDA     | V - VICTOR  |
| J - JOHN    | W - WILLIAM |
| K - KING    | X - XRAY    |
| L - LINCOLN | Y - YOUNG   |
| M - MARY    | Z - ZEBRA   |

APPENDIX E

INFORMATION ON WATS

# WATS INTERSTATE RATE GUIDE

WIDE AREA TELECOMMUNICATIONS SERVICE is for customers who make or receive many long distance calls to and from many points. You may purchase a special "access" line that is connected to the nation wide dialing network. Each such line is arranged at your option for either Inward or Outward service, but not for both over the same line. WATS provides for calls to and from selected service area. The widest area covers the entire country except Alaska, Hawaii, and your home state. You may also purchase WATS on a statewide basis in most states. There is no charge per individual call. You may choose Full Business Day WATS, 240 hours per month, or for a lower monthly rate, 10 hours of service a month, with additional use charged by the hour. Fractional parts of an hour beyond the first 10 hours are measured in tenths of an hour or major fraction thereof. The charge per tenth of an hour is one-tenth of the additional charge.

## INTERSTATE WATS RATES

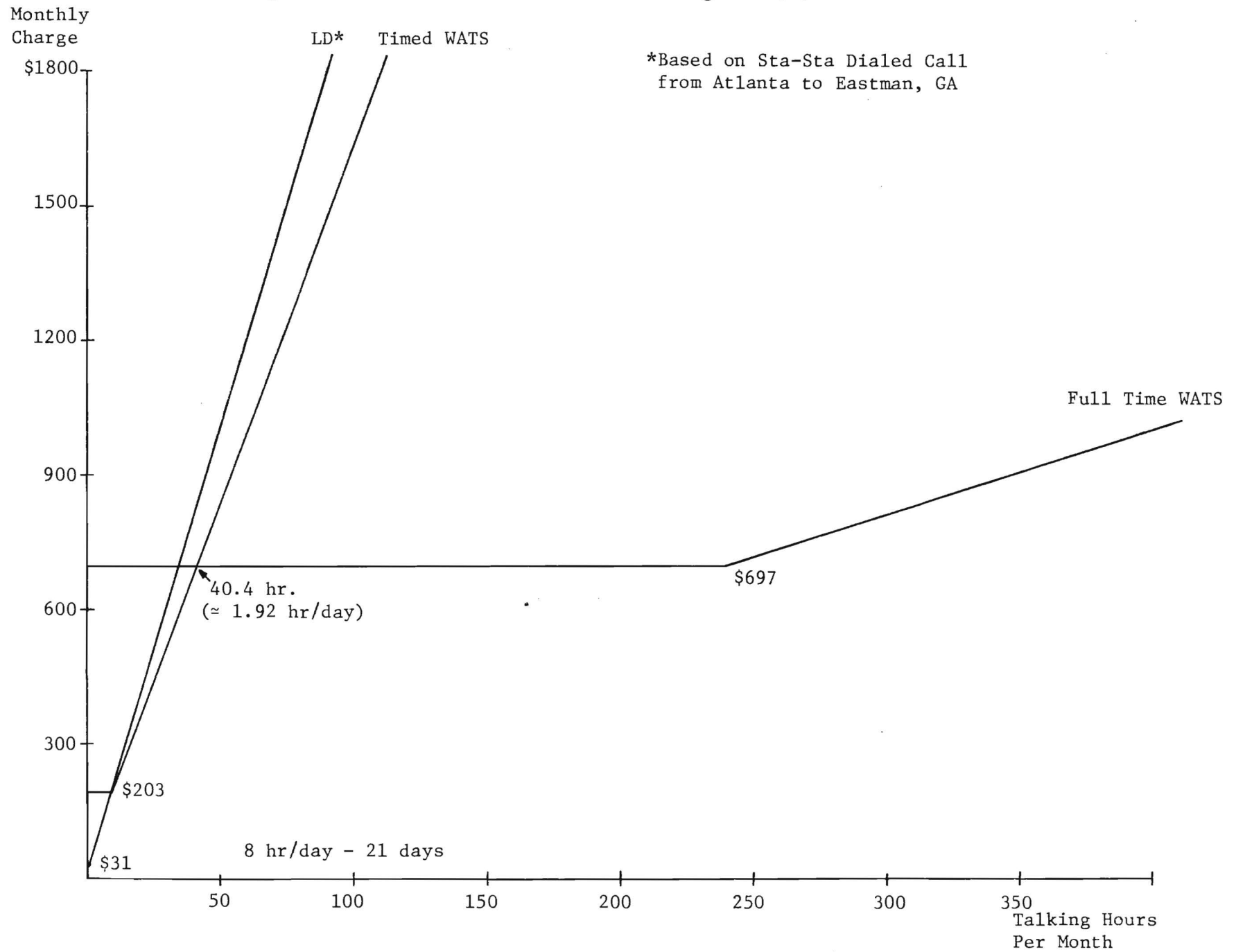
| <u>Zone 1</u>  | <u>Zone 2</u>    | <u>Zone 3</u>    | <u>Zone 4</u> | <u>Zone 5</u> |         |
|----------------|------------------|------------------|---------------|---------------|---------|
| Alabama        | Louisiana        | Missouri         | Texas         | New Mexico    | Utah    |
| Florida        | Arkansas         | Illinois - North | Oklahoma      | California    | Arizona |
| Kentucky       | Illinois - South | Ohio - North     | Iowa          | Washington    | Nevada  |
| Mississippi    | Indiana          | Michigan         | Wisconsin     | Wyoming       | Oregon  |
| North Carolina | West Virginia    | New Jersey       | New York      | North Dakota  | Kansas  |
| South Carolina | Ohio - South     | Pennsylvania     | Connecticut   | South Dakota  | Idaho   |
| Tennessee      | Virginia         | Maryland         | Massachusetts | Nebraska      | Montana |
|                |                  | Delaware         | Rhode Island  | Minnesota     |         |
|                |                  | Washington D.C.  |               | Vermont       |         |
|                |                  |                  |               | New Hampshire |         |
|                |                  |                  |               | Maine         |         |
|                |                  |                  |               | Colorado      |         |

|                        | <u>Area 1</u> | <u>Area 2</u>  | <u>Area 3</u> | <u>Area 4</u> | <u>Area 5</u> |
|------------------------|---------------|----------------|---------------|---------------|---------------|
| Measured WATS          |               |                |               |               |               |
| First 10 hours         | 219.00        | 230.00         | 236.00        | 239.00        | 244.00        |
| Addl. hrs.             | 16.43         | 17.25          | 17.70         | 17.93         | 18.31         |
| Full Business Day WATS |               |                |               |               |               |
| First 240 hours        | 1315.00       | 1570.00        | 1630.00       | 1645.00       | 1670.00       |
| Addl. hours            | 3.65          | 4.36           | 4.52          | 4.56          | 4.63          |
| Installation           | 54.15         | Inmove/changes | 27.08         | Conversion    | 27.10         |

## INTRASTATE WATS RATES

|                                |        |
|--------------------------------|--------|
| Full Business Day              |        |
| First 240 hours . . . . .      | 697.00 |
| Each additional hour . . . . . | 1.95   |
| Measured WATS                  |        |
| First 10 hours . . . . .       | 203.00 |
| Each additional hour . . . . . | 16.25  |
| Installation                   | 58.00  |
| Inmoves/changes/conversion     | 29.00  |

Figure E-1. In State WATS Costs for Georgia - 2/9/77.



APPENDIX F

DIMENSION PBX FEATURES

# Features

## STANDARD

- ATTENDANT CONSOLE
- ATTENDANT TRANSFER - ALL CALLS
- DIAL ACCESS TO ATTENDANT (DIAL "0")
- DIRECT OUTWARD DIALING (DIAL "9")
- DISTINCTIVE RINGING - The distinctive signal option allows the terminating class of service option user to have an indication of the source of the call attempting to reach him using distinctive signals. Three signals are available to indicate:
  - Station-to-Station Call,
  - Attendant handled and outside calls,
  - Originating call waiting call.
- OFF PREMISE STATIONS
- POWER FAILURE TRANSFER - Provides service to and/or from the exchange network for a limited number of prearranged stations during a power failure.
- RECALL DIAL TONE - This feature provides a means of indicating to the station user whether he has successfully used the switchhook flash to request a service feature from an established 2-way call. The result of a successful use of the switchhook flash is dial tone with three interruptions followed by steady dial tone.
- STATION-TO-STATION CALLING
- TIMED REMINDERS - The attendant is automatically alerted after 30 seconds when an unanswered call has been extended from the console. This signal is retired when the loop is reseized by the attendant and is reactivated 30 seconds after the attendant releases the call.
- TOUCHTONE CALLING - PUSHBUTTON TELEPHONE OPERATION

# Features

## FEATURE PACKAGE #2

- ALL PRECEDING FEATURES
- AUTOMATIC CALL BACK - CALLING - Allows a station user to be connected to a previously busy station when the latter becomes idle. The operational steps of this feature are as follows:
  - (1) A station with this feature attempts to call another station and discovers that it is busy.
  - (2) When both parties are idle, the CSS 201 rings the calling party and the called party. If the station which activates the feature originates another call before the sequence has been initiated, the automatic callback sequence is not initiated until both stations become idle.
  - (3) If the callback sequence is not successful within 10 to 20 minutes, the request is deactivated.
- BUSY VERIFICATION STATION LINES - Allows the attendant to establish a connection to a busy line to verify its state. A tone is provided to the busy station (and any parties connected to that station) prior to the attendant connection and every 14 to 16 seconds thereafter. If the station is idle, it is rung normally.
- CALL FORWARDING-BUSY & DON'T ANSWER - When activated by a station user (using a different access code than used for the all calls feature), all calls intended for the station line encountering a busy or don't answer condition are automatically routed to another station line (or to the attendant) selected by dialing during activation. The selected station line must also be in the same CSS 201. The forwarding of don't answer is delayed to allow time for using this feature. Use of this feature, however, temporarily cancels automatic callback-calling, outgoing trunk queuing, call waiting services, and call forwarding all calls for the line.
- EXECUTIVE OVERRIDE - Allows the station user to bridge onto a busy connection. Before the connection is established, a burst of tone is applied to advise the talking parties of the bridge.
- PRIVACY & LOCKOUT - Privacy automatically splits the connection whenever an attendant would otherwise be bridged on a call with more than one facility, e.g. with a calling and a called party. Lockout denies an attendant the ability to reenter an established connection held on the console position, unless recalled by a station.



# Features

13

## FEATURE PACKAGE #2

- REMOTE ACCESS TO PBX SERVICE - This feature permits an outside party to dial access WATS lines and other PBX special services such as FX trunks, CCSA access, or the tie trunk network via local central office trunks. The calling party dials into the system on a local CO trunk and dials a special 3-digit code to unlock the special service PBX access. Once the access has been unlocked, the calling party hears PBX dial tone and places the call as though he were connected to a PBX line terminal. All signaling is done on a TOUCHTONE basis and the special 3-digit code is readily changed by the attendant.
- SERIAL CALL - Allows the attendant to maintain supervision of an incoming trunk on the console after it has been connected to an internal CSS 201 station. When the station goes on-hook, a visual indication is given to the attendant so that the trunk can be picked up for assistance.
- TRUNK VERIFICATION BY CUSTOMER - Provides the attendant access to individual trunks of a group to verify supervision and transmission. Where a busy trunk is encountered, a two second bridge connection is provided to verify use. To gain access to individual trunks, the attendant must dial a test access code followed by the normal access code of the trunk group (or direct select the group) followed by the individual number of the trunk to be tested. A warning tone is provided to the parties using the trunk facility if it is busy.
- TRUNK TO TRUNK CONNECTIONS - This feature allows an incoming or outgoing trunk call to be extended to another outgoing trunk. Trunk-to-trunk connections can be effected among the following types of trunks: CO, FX, WATS CCSA Network, and Tie Trunks. All combinations of these trunk connections can be effected by the attendant. In addition, Tie Trunk-to-CCSA Network (cut through) and Tie Trunk to CO (or FX WATS) may be dialed directly by a station user. Disconnect supervision can be automatic in some cases. In others, the attendant must monitor the connection and manually disconnect after use.
- THREE WAY CONFERENCE TRANSFER - A station user can, by flashing the switchhook while on any 2-party call, effect a 3-way conference and transfer. After the switchhook is flashed, the station user dials the third party (maybe a trunk) for private consultation while the second party is held in a waiting state. By flashing a second time, a 3-way conference is effected. Subsequently, a transfer is accomplished when the original party goes on-hook. The controlling station can drop the third party by flashing during the 3-way conference. (The third party may not be loudspeaker paging.)